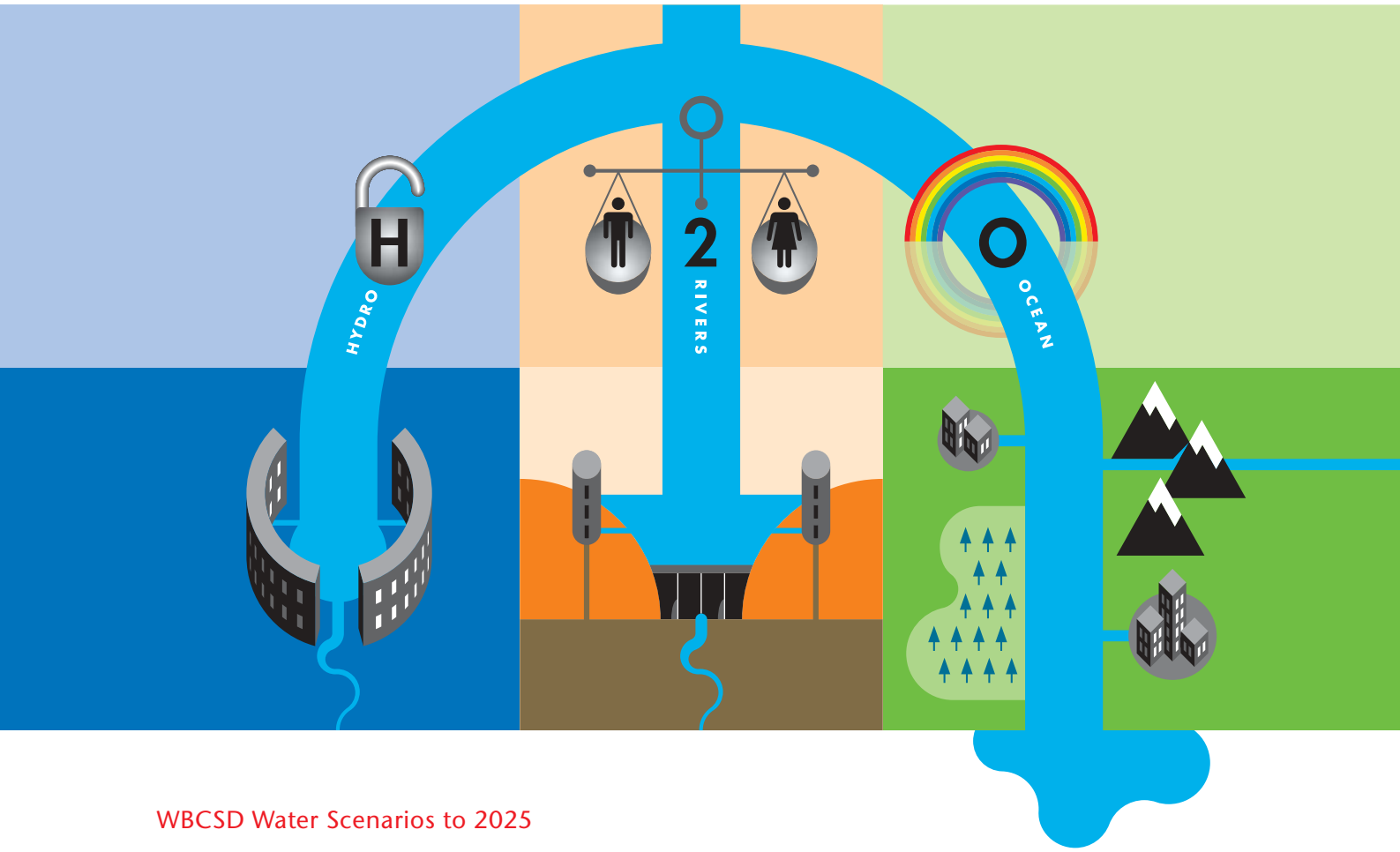
DEDICATED TO MAKING A DIFFERENCE

Business in the world of **water**



WBCSD Water Scenarios to 2025

World Business Council for
Sustainable Development

About the WBCSD

The World Business Council for Sustainable Development (WBCSD) brings together some 180 international companies in a shared commitment to sustainable development through economic growth, ecological balance and social progress. Our members are drawn from more than 30 countries and 20 major industrial sectors. We also benefit from a global network of 50+ national and regional business councils and partner organizations.

Our **mission** is to provide business leadership as a catalyst for change toward sustainable development, and to support the business license to operate, innovate and grow in a world increasingly shaped by sustainable development issues.

Our objectives include:

Business Leadership – to be a leading business advocate on sustainable development;

Policy Development – to help develop policies that create framework conditions for the business contribution to sustainable development;

The Business Case – to develop and promote the business case for sustainable development;

Best Practice – to demonstrate the business contribution to sustainable development and share best practices among members;

Global Outreach – to contribute to a sustainable future for developing nations and nations in transition.

Business in the world of **water**

WBCSD Water Scenarios to 2025

Acknowledgements

Scenarios Project Management Team: Joppe Cramwinckel, The Shell Group; Jürg Gerber, Alcan Inc.; Jack Moss, Suez; and the WBCSD Water Project Team.

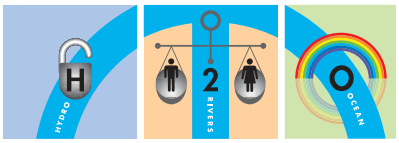
Scenarios Project Core Team: Air Products and Chemicals, Inc., Alcan, Inc., BHP Billiton, Ltd., Borealis, Cargill, Inc., Caterpillar, Inc., CH2M HILL, The Coca-Cola Company, ConocoPhillips, Environmental Resources Management Group, GrupoNueva, S.A., Panamá Canal Authority, The Procter & Gamble Company, Rabobank Group, The Shell Group, Severn Trent, Plc., Sonae SGPS, S.A., Suez, Unilever N.V.

Co-chairs of the WBCSD Council Project on Water: Alberto Alemán Zubieta, Panamá Canal Authority; H. (Bert) Heemskerk, Rabobank; Yves-Thibault de Silguy, Suez.

Close to 200 participants from different cultural and professional backgrounds were involved in this 2.5-year project. Nearly half were from business; the rest were from NGOs, governments, and academia, and other institutions dealing with water issues. These included: Food and Agriculture Organization of the United Nations (FAO), US National Council for Science and the Environment, China Environment and Sustainable Development Reference and Research Center, Millennium Ecosystem Assessment, New Zealand Ministry of Health, The City of Knowledge Foundation, Wychwood Economic Consulting, Ltd., Kummer EcoConsult, the Centre for Ecology and Hydrology, Fraunhofer ISI, KCL/SOAS London Water Research Unit, Swiss Federal Office for the Environment (FOEN), United Nations Environment Programme – Finance Initiative, IRC International Water and Sanitation Centre, ICLEI – Local Governments for Sustainability, World Economic Forum Water Initiative, College of Environmental Sciences of Peking University, National Business Initiative- South Africa (NBI), Water Policy Research Center in the Department of Environmental Science and Engineering of Tsinghua University, The Macao Water Supply Co., Ltd., WWF, WaterLife Foundation, The Johns Hopkins University, Kiwa Water Research, European Water Partnership, The World Conservation Union (IUCN), Business Council for Sustainable Development Malaysia, PepsiCo, Tokyo Jogakkan College, AquaBioTronic LLC, Petro-Canada, Ecologic - Institute for International and European Environmental Policy, ITT Corporation, Institute for Organisational Communication IFOK GmbH, Cranfield University, Alcoa, AVINA Costa Rica, Institute of Environment and Sustainable Development in Agriculture (IESDA), Chinese Academy of Agricultural Sciences (CAAS), Novozymes.

Scenario Expert: Angela Wilkinson
Writer: Betty Sue Flowers
Design: Grundy & Northedge

ISBN: 2-940240-93-0
Printer: Atar Roto Presse SA, Switzerland.
Printed on paper containing 50% recycled content and 50% from mainly certified forests (FSC and PEFC). 100% chlorine free. ISO 14001 certified mill.



Contents

Foreword: The WBCSD Water Scenario Project		4
Business in the World of Water		9
The H2O Scenarios – An Overview of Different Imagined Futures		15
The Scenarios	**H – Hydro**	**17**
	2 – Rivers	**27**
	O – Ocean	**35**
Navigating with the WBCSD Water Scenarios		43
Glossary		47
References		48

List of Boxes, Figures, and Tables

Scenarios Are Not Forecasts	6
WBCSD Scenario-Building Process	7
The Global Water Challenge	8
Legacies	12
A Scenario Overview	16
Urbanization and Water Stress	18
Water and Energy	18
China Water Facts	20
Global Water Remedies	22
Options for Water Efficiency	24
Emerging Middle-Class Lifestyles and Cultural Norms	30
Water Reallocation: Political vs. Market-Based Models	32
Africa and Water	32
Water Wars: Is Conflict Inevitable?	33
Coastal Cities and the Rise of the Sea	39
Virtual Water Flows in Traded Crops	40
The Water Ladder	41
Managing the Panama Canal	42
What Business Can Do	45
Which Water? What Actions?	46

Foreword

The WBCSD Water Scenario Project

“Water – a colorless, transparent, odorless, tasteless liquid compound of oxygen and hydrogen.
The Concise Oxford Dictionary

Everyone understands that water is essential to life. But many are only just now beginning to grasp how essential it is to *everything* in life – food, energy, transportation, nature, leisure, identity, culture, social norms, and virtually all the products used on a daily basis. With population growth and economic development driving accelerating demand for everything, the full value of water is becoming increasingly apparent to all.

Businesses cannot afford to ignore this trend. For some it means new economic opportunities in making water available to meet demand or in finding solutions to improve water quality and water use efficiency. For others, it means closer scrutiny of how they, their supply chains, and their markets access and use water, and of how new business risks emerge as they compete with other users. In any case, it is time for businesses of all sectors and sizes to add water to their strategic thinking.

The World Business Council for Sustainable Development (WBCSD) has been documenting successful business experience in water management, partnerships, and provision of water services to the poor since it formed its first water working group in 1997. In 2004, the group of WBCSD member companies that we represent decided to reinforce our collective effort to help businesses understand why they should be thinking about water and what they can do about it.

We recognize that the world of water is changing and complex, and that our best hope for new insights and strategies for action lies in pooling our individual perspectives and experience. Because water is everybody’s business, business needs the help of other actors in society to get to the issues that really matter.

We chose to build scenarios because scenarios provide a platform for coming to a more systemic and shared view of the bigger and deeper picture. Furthermore, building and using scenarios can help forge shared commitment, as well as shared understanding, by acknowledging uncertainties, by respecting differences in perspectives, and by pointing beyond the problem to explore what solutions might unfold and to what effect. Our specific objectives in building these scenarios were threefold:

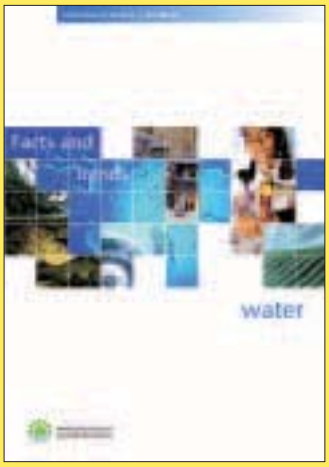
1. Clarify and enhance understanding by business of the key issues and drivers of change related to water.
2. Promote mutual understanding between the business community and non-business stakeholders on water management issues.
3. Support effective business action as part of the solution to sustainable water management.

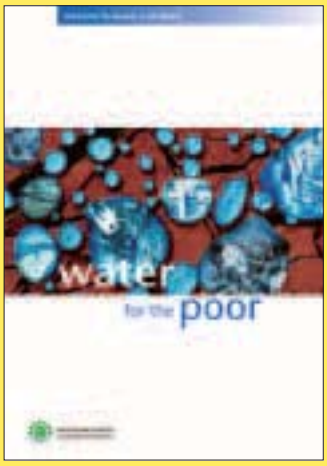
We began by reviewing basic information about the current world water situation and by identifying specific actions that businesses can take. This resulted in two publications: *Water Facts & Trends* and *Collaborative Actions for Sustainable Water Management*. We then launched the scenario process as an ideal tool to enable us to look into the future and to act more effectively together in building a platform for dialogue and understanding through constructive engagement.

The project involved a series of five workshops with the participation of almost 200 individuals drawn from business, government, intergovernmental and non-governmental organizations, and academia. In an effort to identify issues of global relevance, the initial orientation workshops were held in Panama, China, and Switzerland. The scenario-building workshop was held in The Netherlands and the final workshop in Washington, D.C.

This book presents the three stories that have emerged from rich and varied discussions as project participants explored ways in which the future may or may not be like the past and why traditional forecasting methods are not good enough. The stories are primarily intended to encourage businesses to ask "What if?" as they test the robustness of their strategies, policies, and principles across a range of plausible, alternative futures in relation to water. As the product of a collaborative process involving many stakeholders, these scenarios also offer value as a catalyst for joint exploration with other actors in society of how businesses can contribute to sustainable water management. The final chapter aims to stimulate ideas about how to use the scenarios and encourages customized approaches tailored to meet the needs of individual organizations.

These scenarios – the 'H2O Scenarios' – are thus a starting point. Taken as a set, they provide an aid to navigating the rapidly changing world of water. During the scenario-building process, we gathered more information than we could include in the scenarios. This additional material – such as information on new technologies, water reuse, valuing nature, and water use in the life cycle of goods and





services – can be downloaded from the WBCSD website (www.wbcsd.org/web/H2Oscenarios.htm).

For most businesses, the journey has only just begun. We are pleased to share this work with the broader business community in the hope that it will encourage all to get on board so that we may continue to learn and act together. We are also deeply grateful to the many individuals and organizations that shared their time, knowledge, experience, and insights in the course of this project. Their input has been invaluable, and their enthusiastic support for the undertaking has strengthened our commitment to steer our course from understanding to action.

– The WBCSD Water Scenarios Project Team

Scenarios Are Not Forecasts

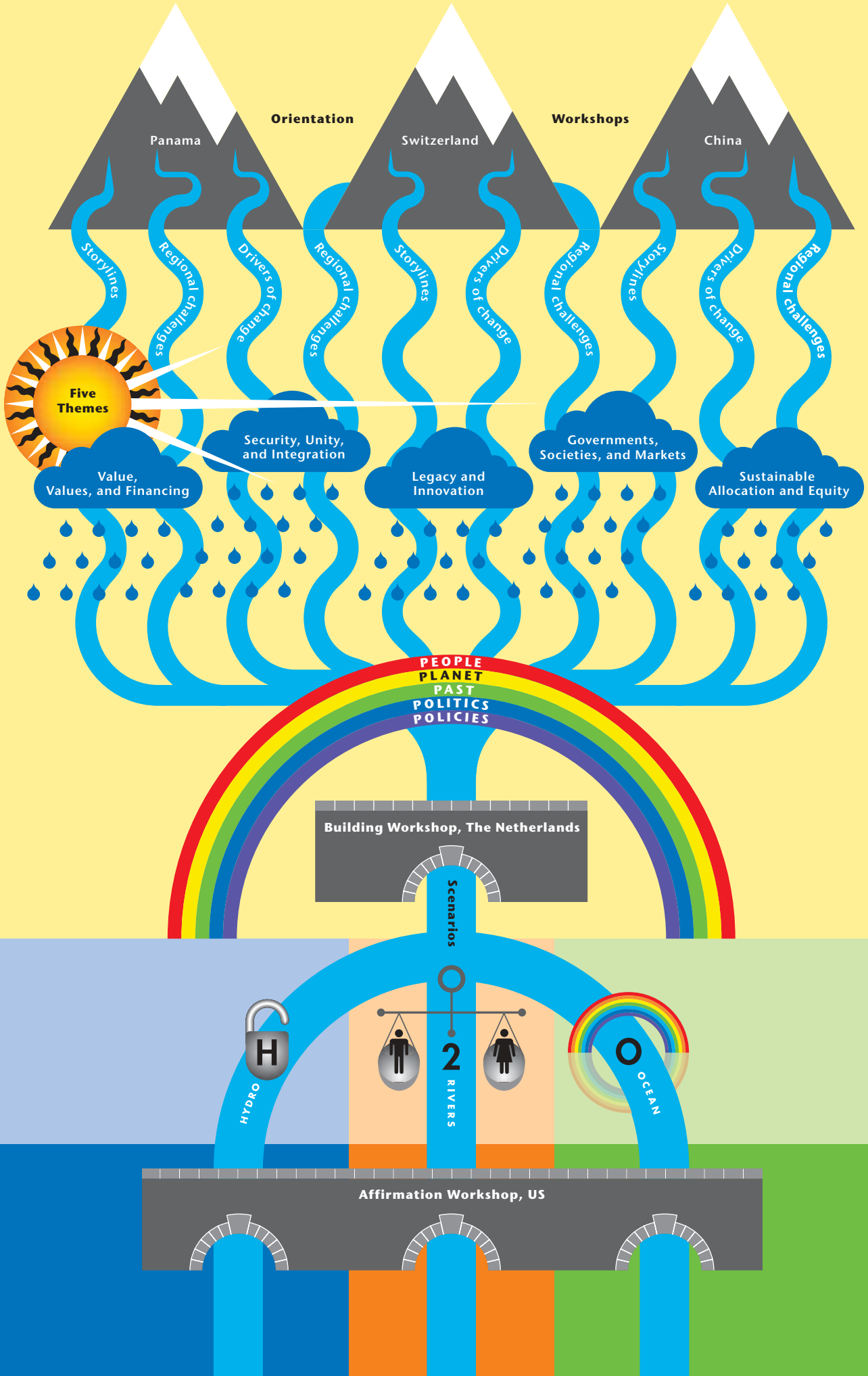
These scenarios are stories about the future that are designed to test the mental maps that managers hold. They are also used for testing the robustness of business strategies in different imagined futures. But perhaps most importantly for scenario projects involving many different companies, they can be used to create a shared space for dialogue about an issue of growing significance that offers enormous opportunities and risks for business – an issue, for example, like water.

Scenarios differ from forecasts in that they always come in sets – two, three, or more equally plausible, relevant, and challenging versions of a possible future. A forecast is based on a single interpretation of the best information we have about the present as it is extrapolated into the future. Fundamentally, a forecast assumes that the future is fairly similar to the past or that we understand with a fair degree of certainty what is likely to happen. Scenarios, in contrast, offer multiple versions of an unknowable future. They also sometimes combine forecasts for various key factors, thus bringing about new insights about correlative or synergistic effects. To engage with scenarios is to hold two or more stories in the mind at the same time – and therefore to hold the future not as a belief, but as a fiction. Such stories help to deal with uncertainty without turning that uncertainty into a false sense of certainty. In addition, they help to handle the multi-dimensionality of our future.

Scenarios move from what is known to what is not known. In addition to changing mental maps, engaging with scenarios can reveal blind spots as well as expose areas where strategies may not be robust. Rather than offering answers, they create a common language and a shared context so that we can begin a strategic conversation. To change the way we act, we must first change the way we think – and scenarios are a platform for effecting this change.

► **This diagram illustrates our scenario-building process. The three orientation workshops (on the top of the diagram) highlighted regional challenges from which common global challenges were extracted. Reflection on these outcomes led to 'meta-themes', which were further refined at the Building Workshop. The Building Workshop gave rise to three embryonic storylines that evolved into H, 2, and O – *Hydro*, *Rivers*, and *Ocean*. These are linked to the meta-themes through the 5 Ps – People, Planet, Past, Politics, and Policies. Finally, the Affirmation Workshop ensured our scenarios reflect the many challenges that the process has brought to light.**

WBCSD Scenario-Building Process



H2O

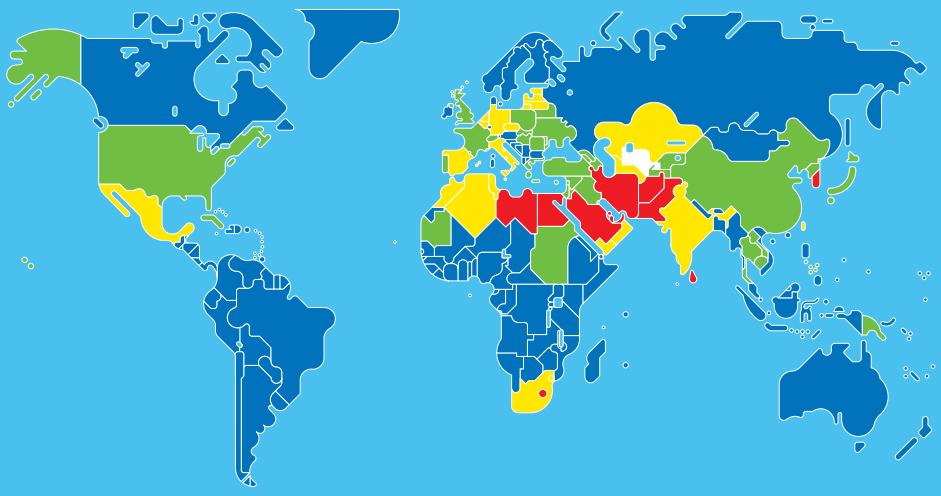
The Global Water Challenge

Freshwater Stress

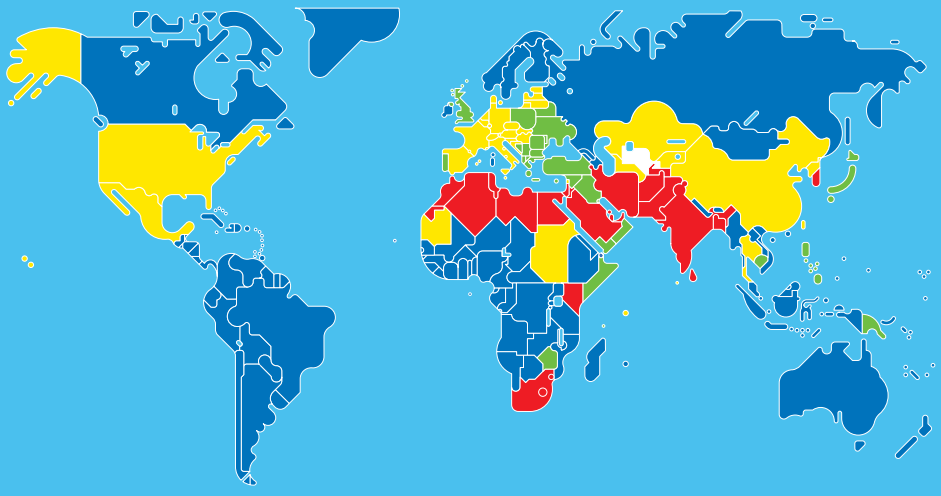
The following map projects how much water will be withdrawn with respect to the amount that is naturally available.

over 40% | 40% to 20% | 20% to 10% | less than 10%

1995

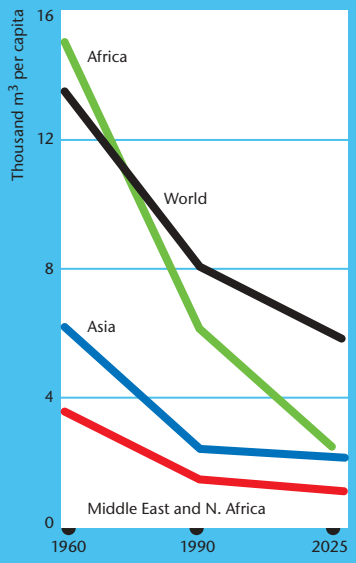


2025



Source: Adapted from "Vital Water Graphics," UNEP, 2002.[1]

Per Capita Water Availability



Source: Adapted from Grey and Sadoff, "The Global Water Challenge," 2006.[2]

Complex Interplay of Local and Global Influences

Politics – insecurity and cooperation

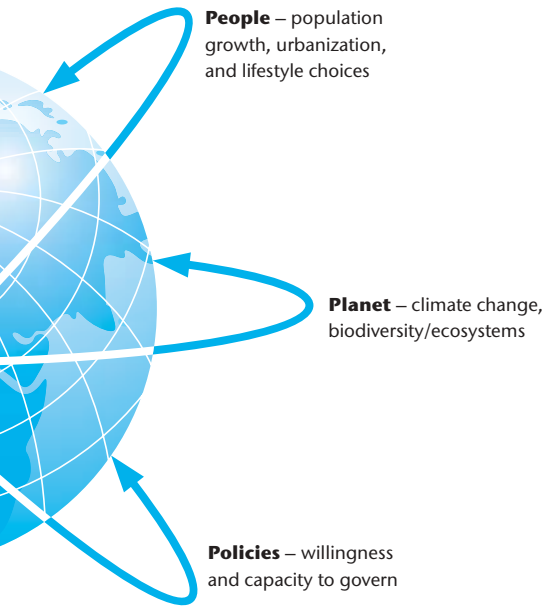
Past – physical and other legacies

Business in the World of Water

“There are alternative sources for energy. There are no alternatives to water.

Sustainable Development International, 2005

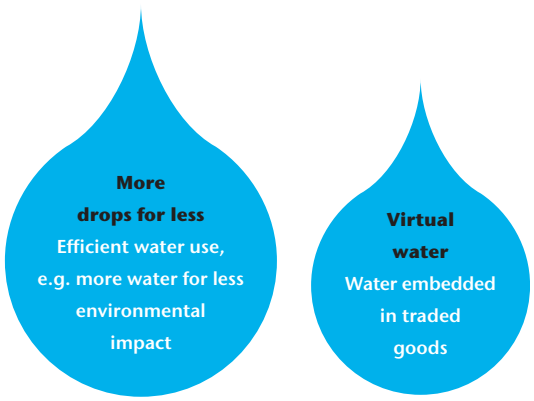
Water should be high on the business agenda because all businesses depend on water. The continuity and future success of any business are impacted by the availability, cost, and quality of water at many points along the ‘value chain’, including ‘upstream’ (in the production and supply of raw materials), ‘midstream’ (in what businesses make from raw materials or other pre-processed inputs), and ‘downstream’ (consumers need water, and everyone needs water to be treated and recycled). Like people and governments, businesses tend to ignore water until it becomes scarce, polluted, too expensive, or in some way is mismanaged. But in the near future – as a result of changes in both human and natural systems that affect water availability, access, affordability, and quality – the water management challenges facing humanity will become more complex. The prospect of water shortages, scarcities, and stresses will increase.



Increasing Shortages, Scarcities, and Stresses

In considering the context for the water challenges that face business, we explored five interacting drivers of change in which these challenges are most clearly seen:

- **People** – for example, population growth, urbanization, sanitation, water supply, demographic and structural changes, increasing per capita consumption of water with economic development and lifestyle changes, rising water supply-sanitation gaps, public health and pollution burdens, the growing reach and impact of city water needs and discharges on ecosystem services and products.
- **Planet** – for example, ecosystem degradation, biodiversity losses, climate change leading to sea-level rise and changes in the hydrological cycle, rainfall patterns, natural disasters (floods, droughts, hurricanes), the melting of ice caps and glaciers, the rates and patterns of river flow, man-made disasters (such as chemical spills).



- **Past legacy systems** – for example, inadequate or poorly maintained infrastructure, financing and pricing systems, pollution loads, water over-extraction, water-service pricing, cultural practices and attitudes that hinder innovation.

- **Politics** – for example, differing cultural assumptions and means of judging water challenges, inadequate political and organizational systems, lack of political leverage, upstream-downstream issues, access, equity, lack of education, cooperation or conflict between users, including intergenerational, international and intra-urban disputes, water as lacking any political value as an issue, manipulation of information, lack of a political voice for the ecosystem.

- **Policies** – for example, lack of coherent policies and their application (governance), varying emphasis on a range of policy objectives (for example, efficiency, security of supply, wider access, and equity), shift towards adaptive policies, issues of best practice, public-private partnerships, capacity-building, corruption, difficulties inherent in creating policies regarding embedded water in global trade, global water management issues.

The world of water issues is potentially paralyzing in its complexity – so to deal with this complexity in a way that would encourage a cross-sector business dialogue on these issues, we created a set of water scenarios. The 'H2O' scenarios help make sense of the evolving complexity and focus attention on three significant global water challenges that will combine to impact businesses and societies everywhere – the *efficiency challenge*, the *security challenge*, and the *interconnectivity challenge.* Each of these challenges incorporates many other challenges to business that are emerging from the changing status of water.

The Efficiency Challenge

With economic development, water demand increases more quickly than population. The resulting stress on water resources is exacerbated by low water-use efficiency, especially in the agricultural sector, caused by factors such as outmoded water systems, poor regulatory enforcement, ineffective price signals, and the lack of incentives for changes in behavior, particularly by those who claim historical rights to water access. The *efficiency challenge* in the world of water calls for more value per drop – and "more drops for less," including the value that comes from more jobs per drop, less energy and pollution per drop, efficient water use, and more water for less environmental impact.

This *efficiency challenge* leads to the business challenge of *innovation* – not only in producing new products and services, but also in avoiding or addressing legacy constraints – for example, established infrastructure and technology standards, social habits and attitudes, and standard business practices. These behaviors and norms were appropriate for a bygone era (for example, a context of abundant cheap energy) and within a certain socio-economic and political context (for example, food security and priority for agricultural water uses), but not for current or future conditions (for example, increasing urbanization and post-industrial economies). The biggest challenge of all will be to meet the water needs of the two billion people living in poverty in the developing world.

How can businesses be encouraged to see water-related problems and constraints as opportunities for innovation and value creation? What are the dilemmas raised by the multifaceted efficiency challenge (more value per drop, more drops for less, less pollution and energy per drop, more jobs per drop)? Will further urbanization intensify the water crisis, or does it provide

> **Knowing is not enough; we must apply. Willing is not enough; we must do.**
>
> *Goethe*

A company's social license to operate in any market depends on constructive dialogue among the different stakeholders – community members, farmers, companies, and others – about how precious water resources will be shared to meet competing demands.

an opportunity to find a solution? Which legacies need to be unlocked to enable more sustainable water practices and more appropriate solutions? Which sectors will need to take the lead in partnering with municipal and national authorities to ensure city solutions are agreed and implemented on a sufficiently fast and large scale?

The Security Challenge

The increasing stress on local water supplies in many parts of the world raises the issue of water *security* – quantity and quality for all. Business plays a major role in ensuring water security, not only directly, through its role in developing, installing, and operating water technologies and services, but indirectly, through its role in the international food trade. Future water and food security will depend even more on trade. Most important of all, business provides the livelihoods that enable families to pay for their food and water.

The major challenge in water security is to ensure that water is allocated and managed effectively and that there is enough to meet all needs – including those of the seriously water scarce and of the ecosystem services and products on which many livelihoods and economies depend.

This issue requires businesses to engage with the evolving concept of security, which is shifting beyond the protection of what some have today – in effect, a form of risk management for the few – to the more inclusive and interdependent notion of security for all, through security of the other. The political processes for re-allocating water fairly and effectively are of fundamental importance because if local water security is not maintained, the business challenge will include preserving the *social license to operate* in that area – even for businesses that are not directly involved in water issues. What begins as a security deficit evolves into a 'trust deficit' for business if allocation issues are not fully resolved or become tainted by corruption.

As the number of users and uses of water increases, allocation issues will become even more contentious. These issues are shaped by the increasing interplay of many different and sometimes conflicting concepts of fairness. Addressing allocation in a more inclusive manner and on a fairer basis in order to ensure security for more people raises issues of:

- **Representation** – Who actually participates – or can be trusted to participate – in the decision-making process?
- **Legitimacy** – What forms of evidence and judgements are acceptable?
- **Competency** – Once decisions are reached, can they be implemented effectively? What about the capacity to meet sudden crises? Or to change over time with changing circumstances?

Increasingly, businesses will have to be mindful that concepts of 'representation', 'legitimacy', and 'competency' vary among countries and in discussions about global governance. There are many sides to the allocation issue.

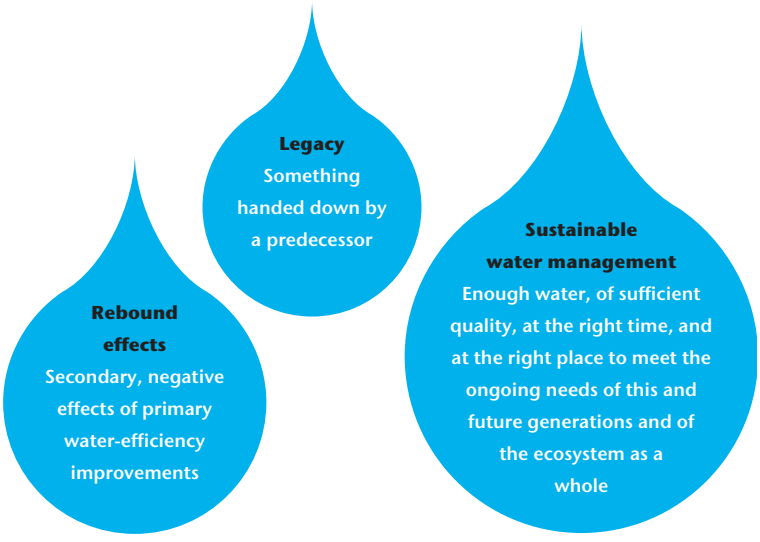
The *security challenge* also reflects a broadening of concerns about quality as methods for detecting pollution improve. This can add a further dimension of conflict – seeing more does not necessarily mean agreeing more, and debates about 'how safe is safe' will continue and even intensify as an increasing range of trace contaminants is detected in water supplies.

Whose water needs and what water uses will matter most? Will business be seen as a legitimate stakeholder in water allocation discussions and disputes? What might happen if the needs of the water have-nots are ignored? What constitutes fair access and use of water – and who will decide? Can all conflicts over water be avoided – and, if not, where will the fracture lines first appear? To what extent can the legacy of corruption be overcome in water management?

Legacies

Some ancient legacies survive today and are beneficial – for example, the Archimedes screw. Some modern legacies may have unintended consequences – for example, desalination. Some new technologies enable sustainability – others may be barriers against it.

Type of Legacy	Unintended Consequences
Cultural Norms and Religious Beliefs	Reluctance to use water from one process for another (for example, reluctance to use oil production water for agricultural irrigation). Use of drinking quality water for all household purposes. The belief that water is a human right, ruling out pricing as an incentive for efficient water use. History of abundance masking awareness of water stress. Exports of lifestyle fashions that include wasteful water habits.
Technological	Dilute-and-dispose approach to pollution relying on rivers having sufficient flow and oceans capable of absorbing inputs. Sunken costs in centralized infrastructure inhibiting alternative solutions (such as decentralized and point-of-use treatment technologies).
Allocation	Inefficiencies, inequities, and conflicts created from historical first-come, first-served allocation basis.
Regulatory	The export of regulations from industrialized countries to developing economies in such a way that the development of more appropriate solutions is inhibited.
Economic/Fiscal	Overseas Development Assistance/Aid for capital infrastructure projects tending to lock out social innovations and decentralized system options. Rebound effects – secondary, negative effects of primary water-efficiency – for example, the use of energy-efficiency savings for long-haul, energy-intensive trips, or the increase in water-consuming activities made possible by the increased savings of income achieved through improved water efficiency.



“Poverty determines water poverty (scarcity); water poverty does not determine poverty.

Tony Allan, Professor of Water and Water Policy, Kings College London and SOAS

The Interconnectivity Challenge

While water is a local issue, ensuring the allocation of sufficient supplies at the right time, in the right place, and of the right quality, increasingly requires consideration of the *interconnectivity* of larger contexts and many diverse stakeholders. Human security and development cannot be isolated from the health and viability of the earth's underlying life support systems. The *interconnectivity challenge* requires us to be able to think and act in terms of multiple geographies of connection, from nation states and city limits to watersheds and river basins, and in terms of multiple timeframes, in order to ensure that short-term interests do not foreclose longer-term possibilities.

The *interconnectivity challenge* also requires us to take into account not only 'blue water' issues of the water we see, such as the water in lakes and rivers, but also the so-called 'green water' contained in healthy soils, and the 'virtual' or embedded water contained in traded products and services. Human security and development also increasingly depend on the ability to consider links in actions and policies relating to food security, energy security, and water security.

The challenge to business in a global environment of increasing accountability is to understand *the business role in water governance* – how to fit into this dynamic, ill-defined, unpredictable set of systems that culminates at the level of a truly global, interconnected, whole system.

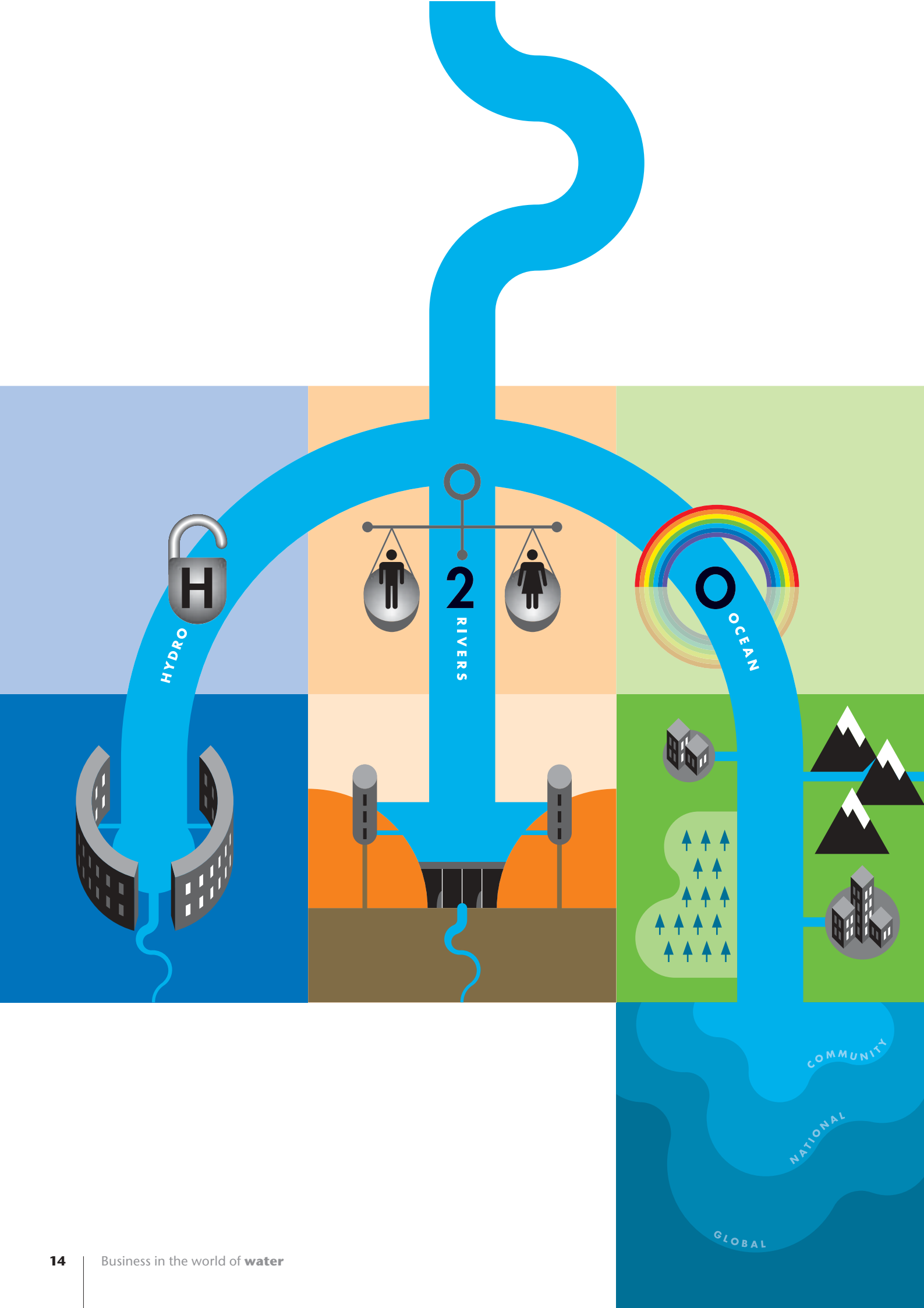
To what extent can human and business activity adapt to new and evolving constraints imposed by the 'big' – or hydrological – water cycle? When we solve a water problem upstream, how can we avoid unintended consequences downstream? How will formal institutional arrangements give a voice to the ecosystem? What are the tensions and dilemmas that need to be surfaced and resolved to govern water at local, national, and global levels? How can more investment be mobilized to finance new innovative schemes for local water solutions?

Learning from the Future

Most companies lack an understanding of the risks and opportunities associated with the changing landscape of water – for example, how increased water-use efficiency can be profitable in a way that can also contribute to a more sustainable use of water. Businesses will be required to understand the political, social, economic, and ecological context of water issues and will need to determine their roles in the collaborative water framework. Sometimes business can take the lead, sometimes it must act in close collaboration with other stakeholders, and sometimes it must simply support government actions and leadership. But whatever it aims to do or is called upon to do, business must pay closer attention to its growing role in the world of more constrained water and ever-tightening supply-demand balances.

Our intention is for these scenarios to offer a tool for usefully simplifying the issues so that different businesses can assess their 'strategic fit' with and state of preparedness for the rapidly changing world of water.

“To change the way we act, we must first change the way we think.


HYDRO
H
2
RIVERS
O
OCEAN
COMMUNITY
NATIONAL
GLOBAL

The H2O Scenarios – An Overview of Different Imagined Futures

The **H2O** scenarios offer three stories about the role of business in relation to the growing issue of water in the world. These stories do not try to cover everything, but attempt to bring to life a limited number of alternative future environments that will challenge economic viability, social legitimacy, and global fitness in the marketplace.

While the three stories together – H, 2, and O – were created in relation to each other, as part of a 'molecular set', they are intended to present mutually exclusive worlds as platforms for discussion.

Hydro is the story of *efficiency* (more value per drop and more drops for less). It highlights avoiding or unlocking legacies inherited from the past – in ways of thinking as well as in technologies, business practices, and public policies – to create new business opportunities in the world of water. The story focuses on the 'H' of H2O – 'Huge' economic opportunities in this new, urbanized world through *innovations*, especially in technology. In ***Hydro***, there is a strategic advantage to being the first to market with the flexible, right-choice solutions rather than being locked out. While the geographical focus of the story is China, ***Hydro*** raises serious questions about other parts of the world. Where else is urbanization at risk from a multitude of water challenges? Where else are governments and their societies likely to respond with market-enabled solutions? The implicit warning in this world of increasing hydro opportunities is that current business and technical solutions cannot be continually or effectively scaled up to solve the growing water stress. In addition, technical and efficiency-focused solutions are not likely to solve the resource allocation problems – that is, who should have the water?

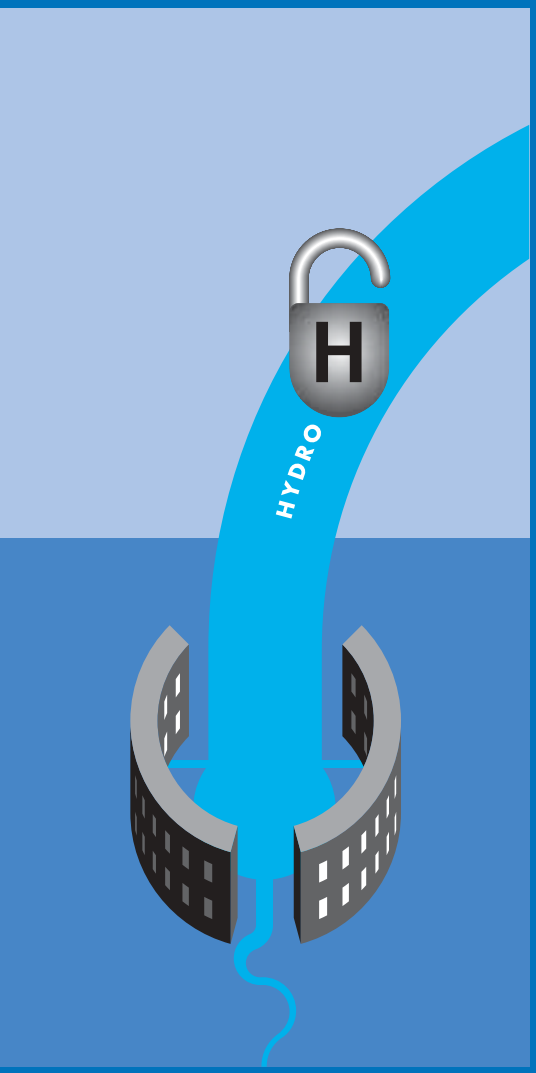
Rivers is the story of *security* – enough water of sufficient quality for both the haves and the have-nots. In this story, cast in the form of a cautionary tale, business recognizes that there are many different sides to security. Some businesses increasingly risk losing the license to operate where they are competing with basic human needs or are out of touch with political realities.

The story focuses on the '2' of H2O – 2 sides of the water question (although sometimes there are more than two sides); 2 sides of a water dispute – often, literally, on opposite banks of a river that divides one territory from another or between upstream and downstream interests; 2 ingredients for meeting future water needs – market-driven solutions *and* far-sighted government policies; and, most importantly, the necessity of solving water problems '2-gether', in partnership with other stakeholders. How do we allocate water fairly for all users in a community, not just the highest bidders? In ***Rivers*** business cannot choose to operate only in the economic realm, which is just one side of the management challenge, if it wants water *security*.

A Scenario Overview

Scenario	Hydro	Rivers	Ocean
Water Challenge	Efficiency (more drops for less and more value per drop)	Security (quantity and quality for all)	Interconnectivity (taking the whole system into account)
Business Challenge	Innovation	Social license to operate	Business role in water governance
The 5 Key Story Themes	• Hard times in huge towns • Huge opportunities • High-stakes innovation • Hydro economy • Beyond legacy systems	• The security deficit • Two sides of the river • The trust deficit • Access and equity • Political reallocation–local solutions	• Unintended consequences • Global Fair Water Movement • The tipping point • Accountability tools • Networked global water governance

Ocean is the story of *interconnectivity* – accounting for the sustainability of the whole system. It focuses on how business begins to recognize its role in a world of bigger, more complex, interconnected, and dynamic water challenges and natural systems in which economies, societies, cities, and individual human lives are embedded. In the world of ***Ocean***, business realizes that it cannot help particular communities survive and prosper at the expense of causing water stress elsewhere. ***Ocean*** is a world that offers new opportunities to help societies and governments achieve more inclusive and integrated forms of security. Like the entirety of the ocean, the enormous whole round 'O' of the H2O scenario set is difficult to see, much less to act in relation to – but if we could imagine . . .



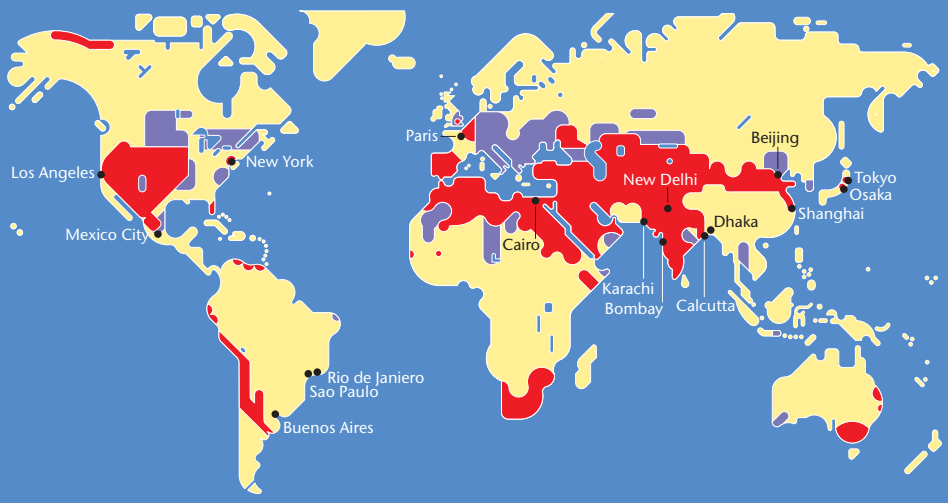
H = Hydro

H2O

Urbanization and Water Stress

Water stress in regions around mega-cities as a ratio of total withdrawals divided by estimated total availability

0 - 0.2 Low water stress 0.2 - 0.4 Medium water stress More than 0.4 Severe water stress

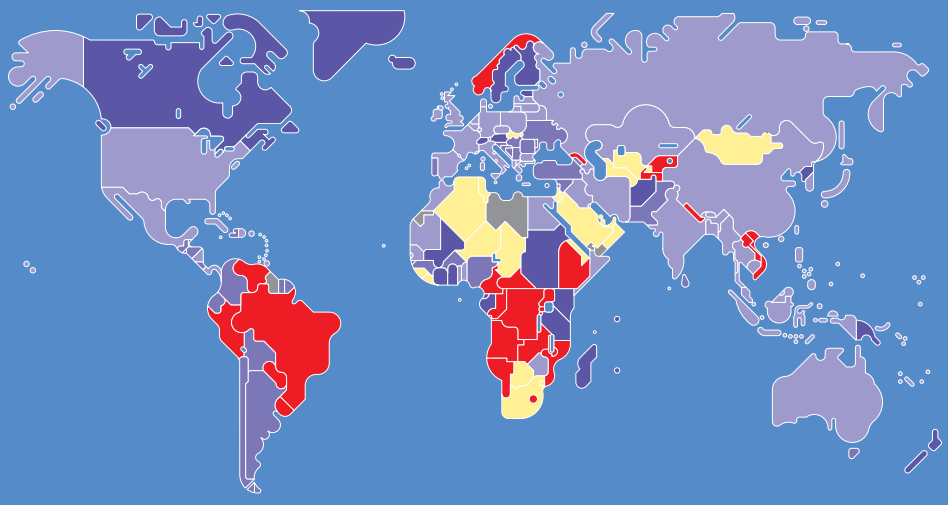


Source: Adapted from UN-Habitat, WHO, and UNDESA, "Cities: Competing Needs," 2003.[3]

Water and Energy

Proportion of electricity generated by hydropower

0 - 1 1 - 25 25 - 50 50-100 100 No data



Source: Adapted from "Water For Life Decade," UN-Water, 2005.[5]

The total electricity consumption of the water and wastewater sectors will grow globally by a predicted 33% in the next 20 years.[4]

H = Hydro

Hydro is the story of *unlocking* additional water sources and greater economic value from every available drop of water. It highlights the promise of technological and institutional innovation that might be released if some of the legacies inherited from the past – in ways of thinking as well as in infrastructure, business practices, and public policies – are transformed to create new business opportunities in the world of water. The story focuses on the 'H' of H2O – 'Huge' economic opportunities – as they might play out in China.

Hard Times in Huge Towns – The Growth of Cities and the Challenge of Water

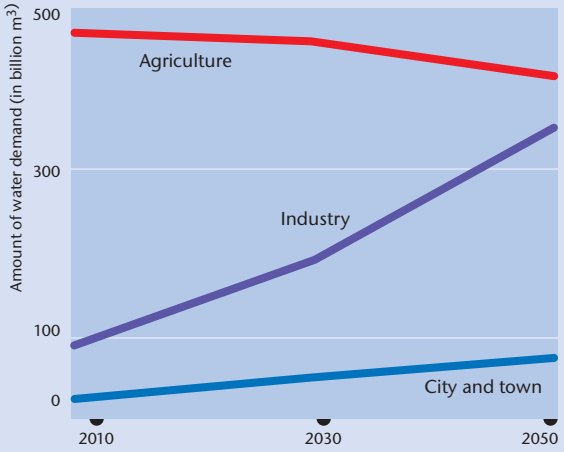
By the end of the first decade of the 21st century, there are 22 'mega-cities' (cities with a population of at least ten million),[8] most of them in developing economies. More significantly, each of the 20 mega-cities that existed in 2003 has several million more people – and many 'secondary' cities are rapidly approaching mega-city status. Other cities are surrounded by suburban areas that, in effect, create large urban areas, even where the city itself is not technically counted as a mega-city. Almost all mega-cities face major freshwater, wastewater, and flooding challenges, but the crisis is particularly acute in China, where the number of the largest 660 cities with water shortages has risen from 400[9] in the early part of the century to 550 by 2020.

While China's GDP growth in the first decade of the 21st century continues to soar at 8%, its rate of resource consumption is growing even more rapidly. There is a deep concern that China's growth is a direct function of resource consumption and not of productivity improvements. For example, the amount of water used to produce a ton of steel in China ranges from 23 to 56 cubic meters, whereas in highly industrialized countries, such as the US, and Japan, the average is less than 6 cubic meters.[10] China's rapidly growing textile industry, among others, is a major user of water and creator of pollution. The growing demand for resources leads to serious over-exploitation and a decline in the availability of water for domestic, agricultural and industrial use, as well as energy production. This challenge is clearly recognized in China's five-year plan, whose ambitious targets prove impossible to reach.

- **World energy consumption is expected to double by 2035 relative to 1998, and triple by 2055.[6]**
- **Current electricity production from fossil fuels and nuclear energy requires 39% of all freshwater withdrawals in the United States.[7]**

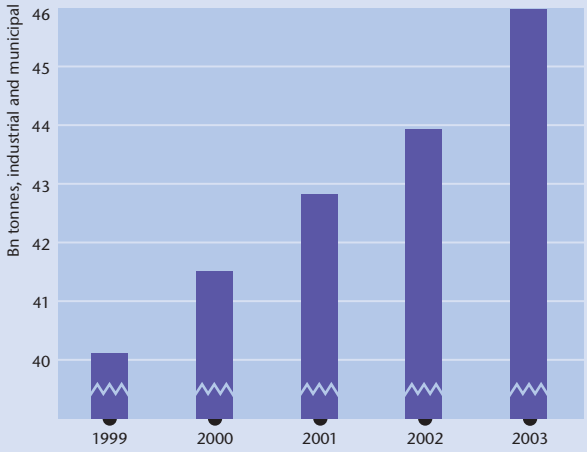
China Water Facts

Future Water Demand Trends in China



Source: Adapted from Chinese Academy of Science, 2000.[11]

A Rising Tide — China's Wastewater Discharge



Source: Adapted from "A Great Wall of Waste," *The Economist*, 2004.[12]

China ranks fourth in the world for renewable water resources, but because of its large population, it has only 1/4 of the global average of water per capita.[13]

In addition to the decrease in water availability, the decrease in water quality significantly impacts public health. Epidemiological studies provide strong evidence that contamination of water resources by industrial and urban discharges is contributing to elevated rates of many types of cancer. Unsustainable demand, which puts too heavy a burden on wastewater treatment (where it even exists), is one cause. Another is the poor enforcement of environmental regulations resulting from lack of alignment between the three tiers of government (state, provincial, municipal).

By 2010, intermittent industrial spills are also increasing in frequency. Over-exploitation of water resources leads to loss of industrial as well as agricultural production, depletion of groundwater, and major rivers failing to reach the sea. Irreversible salinization spreads in China's North Plain, where farmers rely heavily on irrigation. With its fast-growing production output, rapidly rising energy demand, and booming cities, pollution is a major problem in China.

These problems become more frequent, and even though they are not so severe as to catalyze collective action, they do increase both social and economic volatility. China's 'Go West' strategy also exacerbates these problems because people are moved from coastal areas into more water-stressed areas. Water shortages for irrigation lower China's agricultural output, and it must import more and more food. This necessity sometimes has disastrous consequences when other countries find their own food production lowered because of poor water management policies.

Lack of sufficient water to meet energy requirements is also limiting industrial production and the

improvement of living standards in growing cities. In parallel, many of the major engineering-based water diversion schemes initiated at the turn of the millennium are struggling to secure the energy needed to lift, pump, and transport the water, particularly as energy prices rise and power interruptions increase. As a result, China can no longer afford to continue to buy US bonds at past levels. The RMB becomes 'de-pegged' from the dollar, leading to a significant rise in the price of China's exports in the world market.

In the Shadow of the Olympics

The Beijing Olympic Games in 2008 prove to be a real showcase for China with positive international press coverage, especially on the reforestation of the region to the north of the capital. Only a few enterprising reporters cover the rumors of unrest over the increasing shortage of water in the city, with visitors getting priority over the locals. Price increases introduced by the Beijing Municipal Water Authority in 2005 have failed to relieve acute water shortages despite securing continued support from the Beijing Municipal People's Congress.

As water problems increase, tensions between China's rural and urban populations also escalate, in part because preferential treatment is given to urban, industrial centers for water. Shortly after the Olympics, a number of water-related incidents gain international attention. In 2010, a major river is again poisoned by a lethal cocktail of industrial pollution, agricultural runoff, and municipal discharges, creating a local panic in the population dependent on it for drinking water and destroying many subsistence livelihoods that lack alternative sources of water. In response, the municipal water supply in a downstream city is interrupted, and a small fire in the center of the city escalates into a destructive maelstrom before water supplies are hurriedly restored.

Less tragic but still eliciting international attention is the story of a Chinese car parts plant that has to shut down because of major land subsidence caused by over-extraction of local ground water. Following this story, a number of other areas in China are shown to be suffering from subsidence, and the true crisis in ground water supply is widely revealed. Industrial development is restricted in some water-scarce regions, and some industries relocate outside of China in order to avoid water-related problems. Many other industries are putting increasing pressure on the government to act. This pressure, in turn, amplifies the government's own concerns over the failure to meet the decreed targets for water in its five-year plan, including reducing water consumption by 30%. More troubling than these stories to the Chinese political leadership are the political protests springing up in a number of China's cities as well as in the countryside. With World Trade Organization (WTO) membership and its international reputation at stake, China works hard to contain the protests through media controls and non-violent suppression of dissent, but authorities know it is only a matter of time before the issue of water – its quantity, quality, availability, and management – becomes the trigger to the expression of larger dissatisfactions.

Huge Opportunities – Unlocking More Value

In 2012, China begins an all-out effort to solve its water problem, shifting away from its earlier reliance on engineering itself out of the problem. China's leaders understand that poor designs adopted now will incur the economic costs of retrofits as well as the future social costs of water shortages, pollution, and flooding. As they have done with other sectors, the Chinese embark on a period of economic experimentation, harnessing market forces rather than attempting to impose a single way forward. Many of these responses

Global Water Remedies

Technical remedies
Using seawater for industry and agriculture, diverting water from water-rich to water-scarce areas, recycling wastewater, using the heat content of wastewater as a source for regenerative energy supply, using wastewater irrigation to increase production, new groundwater exploration techniques, microbiological wastewater treatment techniques combined with novel membrane separation techniques, nanotechnology, innovative desalination techniques, crystallization techniques, membrane development, cheap point-of-use treatment systems, and consumer products to remove bacteria, viruses, parasites, and heavy metals.

Increasing the agricultural productivity of water
More efficient agricultural approaches, drought-resistant crops, saline water-based agriculture, increased water-use efficiency of agricultural practices.

Re-allocative remedies
Restructuring and relocating industry out of water-stressed areas, refusing to issue licenses for industries using significant water resources.

Economic instruments and economic regulation
Increasing the price of water, increasing regulation for industrial water use.

Environmental protection and related regulation
Protecting and restoring ecosystems that enhance water collection and flood mitigation, incentives for water-saving programs.

Awareness-raising remedies
Sponsoring public education campaigns about water use, setting ambitious goals for reduction in per capita water consumption.

have the effect of driving up not only the cost, but also the appreciation of the true value of water, which is increasingly regarded as precious and protected. In addition, China begins reaping the benefits of the significant investments it has made in science and technology as well as increasing its ability to use existing improved approaches.

The Chinese government is joined in its effort by industry, with Chinese industrialists taking the lead through establishing the "China Business Association for Water" (the CBAW), which promotes China's economic growth through best-in-class water technologies and water management practices. The five-year water plan, issued by the government in 2015, is created with active business participation.

Throughout the post-Olympics decade, China continues to open up its market to outside companies in an attempt to attract state-of-the-art technology and know-how. Companies build and operate water treatment plants for saltwater (on the coast), brackish water (inland in the east), and the recycling of wastewater. Wastewater infrastructure becomes a booming business, too. Manufacturing and processing industries develop many water-saving and water-protecting technologies. Other companies take advantage of

genetic engineering in exploiting newly developed salt-tolerant crops as well as high-value crops raised in greenhouses. An increasing percentage of China's food staples, however, continue to be imported.

During this period, with China in a bind, companies seek and are at first given more market friendly reforms in terms of operations guidelines, taxes, a degree of foreign ownership, etc. Foreign companies compete for the new opportunities, using the water crisis openings as leverage to open other sectors of the Chinese economy to outsiders. Chinese companies, in collaboration with others, establish portfolios of smaller scale and more efficient technologies, which they export to other countries. Meanwhile, in Western Europe, costs of continuing to prop up ageing infrastructure detract from investments in more appropriate solutions. As a result, China's solutions, when offered on the global markets, take many by surprise.

Success encourages the Chinese authorities in collaboration with CBAW to begin an intensive new campaign: "Chinese Solutions for Global Problems." The effect of this new policy thrust is to aggressively promote and grow Chinese-owned companies and to narrow the opportunities for foreign businesses to partner with Chinese businesses – those companies who don't already have a foot in the Chinese door are out of luck.

High-Stakes Innovation

The new 'Chinese Solutions' policy includes generous subsidies for indigenous technological solutions to water problems. And, after a few years, the government lowers the barriers to partnerships, at least in cases where non-Chinese companies can bring new technology to the table. In some rapidly growing areas of China, the lack of a developed water infrastructure means that new prototypes can be applied swiftly with local support and enthusiasm – for example, on-site treatment units to recycle household wastewater in individual apartment houses. The drive for energy efficiency as well as water efficiency leads to innovative decentralized solutions linking the two, such as micro-hydro power units in storm sewers and heat recovery from wastewater in buildings. Chinese firms leverage many of the innovations they have created in green technology to innovate in the area of water and pollution control and systematically realize synergies from both the energy and the water sector.

The key to the success of these ventures is a radical move away from the mega-projects of earlier years, like the Three Gorges Dam, to site-specific technologies tailored to solve local problems. The emphasis is on 'appropriate' technology rather than innovation for its own sake. Such a shift away from large legacy systems has profound results, encouraging decentralized water and wastewater treatment processes, for example, that significantly reduce infrastructure costs. Information technology opens the doors to new standards of reliability and security for such systems through remote sensing, monitoring, and control. Advances in nanotechnology and IT that lead to intelligent membranes result in a step-change in energy efficiency in desalination, and soon bio-saline agriculture begins to grow in coastal areas. In addition, cheap detection systems for pipeline leaks and quality control are developed and become ubiquitous. The combination of pro-efficiency government regulations, alignment of state and provincial relationships, increasing investment in research, and support of venture capital for the new water businesses means that there are numerous new technologies from which to choose. These new technologies extend beyond water businesses to be embraced by many fast-moving consumer goods companies. Their development and deployment rapidly reshape the historical notions of what constitutes a 'water company' or the 'water sector'.

Options for Water Efficiency

Are countries making the best economic use of their water? Will water limit their growth in the future? Countries that are already withdrawing a high proportion of their available water have several possible options, if water is not to constrain future development. They can import more of their water needs in the form of goods embodying water ('virtual water'); they can renegotiate water sharing with neighboring countries; they can take a strategic view to shift the structure of their economies towards less water-intensive sectors; and/or they can waste less and make more efficient use of water in existing sectors.

All these factors enable the Chinese companies to leapfrog over businesses that are constrained in their development by technological and infrastructure legacies or traditional notions of the water sector. China manufactures these new technologies very cheaply and in large quantities and then exports them to Europe and the US at extremely competitive prices. In conjunction with its technology exports, China also creates models for the decoupling of growth from use – that is, growth in population and industry drives a much lower rate of water use per capita than growth has traditionally created in the past.

Because the needs of US and European water infrastructure require hundreds of billions of dollars of investment, cities turn to the private sector for technology solutions – and the Chinese companies are there in partnership with a range of US and European water technology providers and the large water companies. Those foreign companies that invested early in China and developed these key partnerships reap a windfall from China's global export opportunities.

But this kind of partnership is not just a matter of first-mover advantage. The co-production of appropriate solutions often requires outsiders to go further than simply offering 'black-box', patent-protected technologies – a requirement that poses a stiff challenge to the intellectual property model of many Western companies.

The Hydro Economy

By 2020, the hydro economy in China is flowing with creative solutions and opportunities, not all of them small-scale or point-of-use technologies. Many of these focus on spinning the water cycle more quickly, thus making the same amount of water available to be used more often since there is little scope to overcome the basic constraints of raw water resources. Where the outcome is likely to be 'more value per drop', China invests in new large-scale infrastructure for the mega-cities, using those US and European companies who have been partnering with it during the previous decade to help in the implementation.

In this flurry of construction, the Chinese government, again in collaboration with the CBAW, opens its new Global Center for Water Treatment Technology, which attracts researchers from across China and beyond. The Center rapidly brings to local markets a fuel based on the co-digestion of solid and liquid organic waste. It also pioneers the first successful applications of 'smart membranes' that revolutionize wastewater treatment as well as

desalination technology to produce inexpensive, freshwater. New technologies include:

- Packaged systems for water reuse, incorporating energy and nutrient recovery.
- Co-production of water from built-in, fuel-cell-based power units.
- Optimized real-time control of drinking water, wastewater, and storm water systems.

With its international partners, China begins to export these technologies to other water-challenged regions of the world. Eastern European countries are especially eager to import the innovative Chinese small-scale water treatment technologies. In some cases, traditional European water technology companies quickly respond with similar offerings, but struggle to compete on price. In other cases, outside companies are locked out of access to the new technologies. The scale and quality of water treatment implementation achieved in China allow it to set standards for the rest of the world in water treatment technology.

By 2025, China is known worldwide for its cost-effective water solutions implemented on scales that vary from individual apartment buildings to whole towns. Government policies that require households in all major cities to use water-saving products and technologies also contribute both to water savings and to industry profits. China is now the world's largest manufacturer of mass-produced products designed around water supply, recycling, and use reduction. Its brands are internationally recognized and successfully exported to both developed and developing nations.

As Chinese technology becomes the leading technology for water, this success has significant social and political implications. In regions where China gets a large amount of its natural resources, such as South America and Africa, it invests heavily in infrastructure, including water, to ensure strong local economies and secure raw material supply. Developing nations look to China for help with solving water-related health problems as well as for setting up utilities infrastructure. And since this help comes from China's businesses rather than from its government, business begins to play a much more significant role in setting the course for China. Businesses begin, for example, to implement systems for measuring water-use efficiency, partly to demonstrate their effectiveness in water use and partly as a means of pressuring China's government to institute effective water-protecting measures.

Not only is China the leader in water technology, it also is making progress in moving water from a resource that is taken for granted to a major source of economic innovation and growth.

Moving Beyond Legacy Systems

China's success in the new world of water springs from one main source – the capacity of its industries and leaders to unlock the legacy systems that are barriers to change in China, as well as in other parts of the world. These legacies include old ways of thinking as well as old infrastructure, water delivery, financing systems, and mindsets.

In ***Hydro***, China thinks in terms of solutions rather than technologies and, in particular, of water as the central resource in its remarkable rate of economic growth and its international standing as a global player. It recognizes the importance of regional differences, not only in solving particular water problems (for example, when to apply local, small-scale solutions and when to apply large-scale solutions), but also in its formation of management rules (for example, how to set local water pricing) and government regulations and how they are to be enforced.

For those foreign businesses that entered the water game early, Chinese investment in the hydro economy turns out to be lucrative.

These far-sighted businesses have gone where the growth is and learned to unlock business opportunities in a world where water legacy systems are either weak or capable of being superceded by the plans of a strong government.

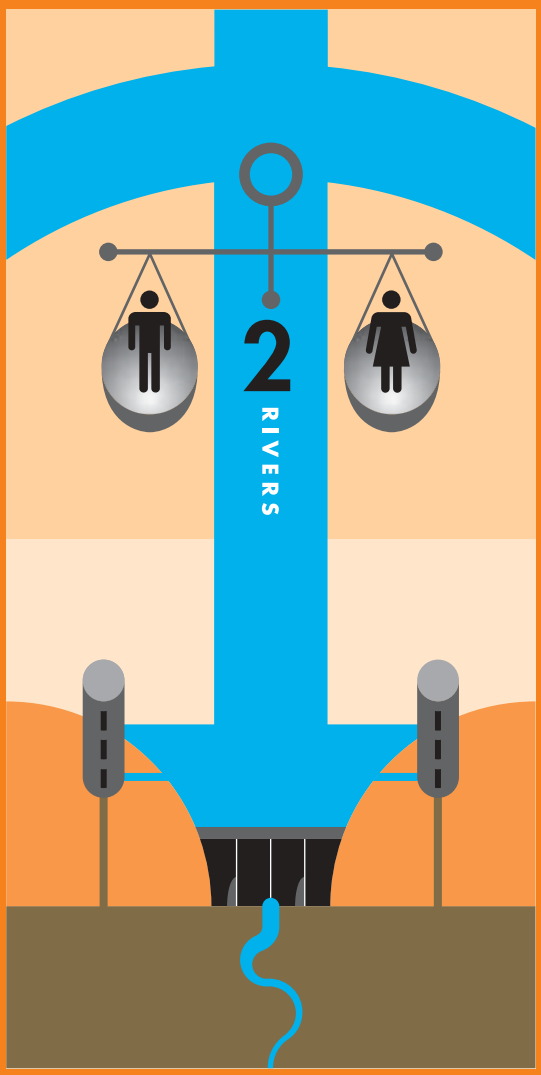
But in the midst of the China water success story, there are still dark currents that threaten the society. Not all legacies have been overcome – bribery and corruption create hindrances to the successful working out of water policy in some areas. And many people are beginning to recognize the environmental degradation and ecological impacts spurred by early stages of both increased industrial growth and the so-called 'green revolution', which used intensive farming methods to improve agricultural productivity. In addition, economic growth has exacerbated the gap between rich and poor – and while there is more water available in specific areas, the poor seem to get much less than they need. As water enters the market as a commodity, the poor begin to wonder about their legitimate human needs. And the agricultural sector sees huge conflicts emerging between the water needs of the urban areas and the government emphasis on self-sufficiency in agriculture.

In addition, the emphasis on water efficiency is beginning to be matched by ever more creative uses of water – reminiscent of what happened in the energy world after the 1970s' oil shock and the subsequent increase in energy efficiency, accompanied by an increase in use. As water use and energy demand continue to rise, price volatility and supply interruptions become even more common.

These conflicts are apparent not just in China. Environmentalists in Europe and the United States, for example, seem pitted against industrialists over the use of water for competing needs. Some say that the high cost of meeting excessive standards imposed by the EU Water Framework Directive is hampering the competitiveness of European industry.

Because water is not just a commodity but also a basic human need, technological innovation and a thriving hydro economy are found not to be enough to solve the growing global water issues. Ecological restoration does not always keep pace with the burgeoning population, which places greater stress on the wider, whole system. Nor is it enough for businesses to establish working partnerships with non-democratic governments that can issue and enforce business-friendly policies. While this strategy continues to work in the world of oil, for example, there is an increasing sense that it cannot work long-term in the world of water for the simple reason that oil can be replaced by other fuels, while water – H2O – is the basis for life on earth. In the world of ***Hydro***, we can dam rivers and unlock business opportunities – but eventually, we cannot ignore other, competing interests.

2 =



Rivers

2 = Rivers

***rival* – from L. *rivalis* "a rival," originally, "one who uses the same stream" (or "one on the opposite side of the stream"), from *rivus* "brook. The notion is of the competitiveness of neighbors."**

– Online Etymological Dictionary

Rivers is the story of *securing* water for the haves and the have-nots – including the business haves who increasingly risk losing the license to operate where they are competing with basic human needs and where there is political conflict over resources.

The story focuses on the '2' of H2O – 2 sides of the water question (people and business, business and governments, rural interests and urban interests, industry and agriculture, individuals and communities); 2 sides of a water dispute – often, literally, on opposite banks of a river that divides one territory from another or between upstream and downstream interests; 2 ingredients for water prosperity – markets *and* far-sighted government policies; and, most importantly, the necessity of solving water problems '2-gether'.

In ***Rivers*** businesses can't choose to operate just in the economic realm – just on one side of the river – if they want water *security*. They must also engage with other stakeholders in the community, including partnering with local, provincial, and national governments to safeguard the interests of those segments of society who are unable to pay.

The Security Deficit

Water security means having access to sufficient quantities of water of adequate quality, at the right time and in the right place, to meet a user's needs; and it also includes being shielded from the effects of extremes, like droughts and floods, or having the capacity to be more resilient in response to them. Water availability and quality underpin hygiene and health as well as having an important impact on education, opportunity, and lifestyle quality. Thus, water security is multi-dimensional and is closely linked to social, food, job, and environmental security.

From the point of view of business, water security concerns occur

> **“3.4 million people, mostly children, die annually from water-related diseases.**
> *Gro Harlem Brundtland, former Director-General, World Health Organization, 2001*

1) upstream, where water is a direct or indirect resource, mostly in the form of a component of raw materials; 2) midstream, where water is a significant element in the production process; and 3) downstream, where water is an enabler of product use and consumption. Societies that have inadequate access to water and poor health arising from inadequate sanitation do not constitute healthy markets for business. Business cannot thrive in societies that thirst.

In ***Rivers***, by 2010, the shortage of quality water, especially in the growing cities of many low-income and emerging economies, is recognized as one of the most serious political and social issues of the time. For years, the poor have paid more for their water than the rich. In many cases, their polluted rivers mean that if they want clean water, they have to buy it at inflated prices; in the absence of running water in their homes, they spend time every day fetching it; and if they drink the contaminated water of rivers or lakes, they pay again in the costs of ill health and chronic disease. And these costs are proportionately more of their meager disposable incomes and other assets.

Increased globalization of agriculture has also increased pressure on the rural poor, most of whom are less able than their urban counterparts to afford global market prices for food. Those who have traded subsistence farming for cash crops are also vulnerable to the price swings of global commodity trading. In addition, the tension between food security and global economic opportunity is felt at the local level when, for example, cash cropping melons upstream depletes the water that downstream users need for subsistence farming.

Developing countries are often caught in a Catch 22 – development itself often raises water demand, and tough choices unfold between maintaining and increasing economic growth and ensuring social harmony. How much water should go to those that need the most, to those than can do most with it, or to those that can pay most for it? In many countries, the rich get richer, while the rural poor, and women in particular, suffer as their water and wider human development needs take second place to those of swelling cities and industrial activities.

Even though by 2010 the application of advanced water treatment technology helps to relieve immediate water shortages in some places, citizens in areas of continuing water shortages often distrust local governments in their dealings with the private sector over water allocation. And where trust does exist, the lack of alignment between local governments, regional or provincial authorities, and national authorities hinders progress.

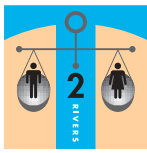
Growing dissatisfaction means that in many regions, deals over who gets what access to water can no longer be negotiated simply among the haves – and if the deals are already done, there is increasing pressure to open them up for re-examination of the sharing of burdens and benefits.

By 2015, the introduction of more sophisticated measuring techniques and a better understanding of the health effects of trace contaminants lead to a closer look at the effect on water quality not only of particular manufacturers and agribusinesses, but also of other, subtler influences – like traces of endocrine-disrupting compounds in urban water supplies. Some groups retroactively attempt to make companies accountable for the indirect consequences of industrial and other activities on declining water tables and even minute degrees of downstream pollution.

Meanwhile historical divides between the rich and poor and the urban versus the rural population are joined by many other equity concerns – intergenerational conflicts, for example, as societies age.

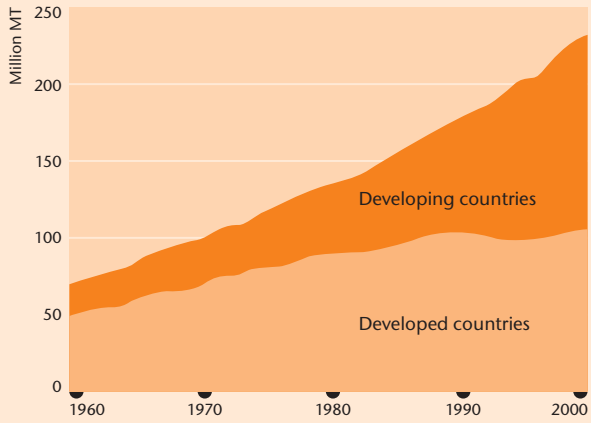
Two Sides

With growing water demand and greater challenges to water quality, the water haves grow increasingly

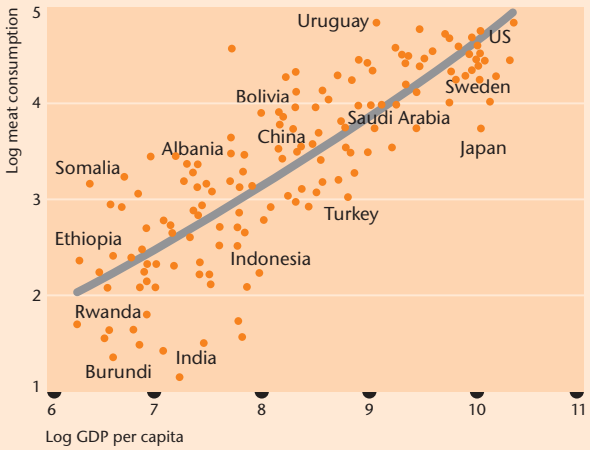


Emerging Middle-Class Lifestyles and Cultural Norms

Changes in meat production in developed and developing countries, 1960-2000.



Per capita meat consumption in relation to GDP.



Source: Adapted from Speedy, "Global Production and Consumption of Animal Source Foods," *Journal of Nutrition*, 2003.[14]

Cleanliness

Showers and clothes washing are simply accepted as part of normal, everyday lives, but this was not always the case. In North America and England, the fashion for cleanliness and its importance in signifying respectability (a moral idea, not an explicit association between washing, health, and hygiene) arose in the late 1700s. The soap tax was abandoned in England in 1852 after 230 years of soap's status as a luxury item.

Source: Adapted from Shove, *Comfort, Cleanliness and Convenience,* 2003.[15]

reluctant to give up what they feel they need. Here and there, intermittent water disputes arise, disrupting supplies or, in other cases, creating ill will for those businesses who happen to be caught in the midst of a local political debate in which political candidates use water issues in support of anti-private sector political platforms.

Many governments are either slow or unwilling to recognize these new power struggles in societies, or feel unable to respond effectively. Politicians see dialogues about reallocating access between the increasingly contested claims of different communities as a losing proposition when it comes to elections. More and more, water becomes a leading-edge issue whenever there is political conflict. In the developed world, for example, the attempt to upgrade old legacy water systems results in ever-increasing charges for water management services, causing significant friction and unrest. For the first time, a significant number of middle-class households struggle to pay their water bills. And in the developing world, the unintended consequence of attempting to provide clean water in places that never enjoyed clean water before is that even the nominal fees charged for such significant improvements are sources of great resentment from people who did not participate in selecting the delivery system for which they are asked to pay.

“Water management is, by definition, conflict management.

Worldwatch Institute, 2005

The Trust Deficit

Rising media coverage of these and other water issues resonates with public dissatisfaction in many OECD countries where citizens increasingly feel that governments are pushing water risk management down to the choice, and thus, responsibility, of individual households. In these societies, there is a growing demand for fairer and more effective water management. But another effect of the rising contentiousness is to increase pressure on EU and US businesses that operate in developing countries. In some areas, companies that appear to be taking water from the poor for industrial, manufacturing or agribusiness use suffer from widely publicized criticism, including boycotting of products in rich countries that hear about these practices. In others countries the lifestyle choices of the few are pitted against the livelihood opportunities of the many.

Sometimes companies are at fault – but often they are not. They just happen to be in the vicinity of other businesses that are seen to be taking a precious resource away. For business, water-related ‘security’ begins to mean more than just a secure supply of water to meet needs – at times it comes close to meaning ‘security of license to operate’ in a water-stressed region.

Some businesses respond by looking closely at how much they rely on external sources for their water supply. They increase their capacity for internal recycling and reuse and can show the efficiency of their water use. Many even point out that they are releasing water from their manufacturing processes that is cleaner than when they received it.

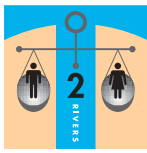
But often, angry citizens and the media do not distinguish between companies who are good water citizens and those who are not. Businesses are exposed to growing claims of moral culpability as well as risks of litigation over their water use, pollution discharges, and environmental damage. In an increasingly blame-and-claim oriented world, these dangers are no longer limited to the company’s direct and controllable action, but also apply to the impacts of the company’s products in use. In many cases, the liabilities extend even further, to the activities of members of the company’s supply chain and to events that occurred long in the past.

Increasingly, the media focus on companies that seem to be complicit in depriving local residents of their fair share of water resources. Businesses who want to avoid becoming water have-nots find they must pay close attention to local governments, municipal authorities, and national social policy and not just to their own behavior or to business trends and new technology.

For their part, many governments begin to use water policy as a mechanism of coercion (asserting the right to deny access), of cohesion (subsidizing water supply and services), and of efficiency (offering incentives for more responsible use and developing policy frameworks to enable more rational pricing). If businesses want to solve water problems, they find that technological fixes are not enough – they must be involved in establishing sound policies for water allocation as well.

Where water allocation policies have not been legislated, political leaders sometimes sponsor nation-wide consultations to determine water allocation priorities. Opposition parties claim the process is not so much an attempt at genuine direct democracy as it is a way for the Executive to disempower the Legislator by avoiding the established decision-making process of representative democracy. The media pick up on the support several companies have extended to enabling these national roadshows and hint at a corporatist conspiracy.

In Europe, the tension is increased by the growing cost of meeting environmental objectives such as those of the EU Water Framework Directive, while unemployment, caused in part



Water Reallocation: Political vs. Market-Based Models

South Africa's 1994 constitution repealed the water legislation of the Apartheid era, which gave access to those who owned land (land ownership being primarily by the minority white population, which owned approximately 87 % of the land, a figure that has changed only slightly in response to land reform). Water use reform thus inevitably means taking from the haves to give to the have-nots. However, taking water from existing productive users to supply emerging users has significant political, economic, and social implications. South Africa can choose one of two strategies for going forward:

The **redistributive model** aims at getting the numbers right in the short term, that is, reallocating water to lots of small users. The **economic growth model** aims at boosting the economy and jobs in the expectation that the benefits will trickle down to everyone.

	The redistributive model	The economic growth model
Emphasis	Numbers Livelihood support Social needs Equality Politics Society	Benefits of use Jobs and income Equity IWRM (Integrated Water Resources Management) Technology
Water-Use Patterns	Lots of small users Self-employed Local schemes Short value chains Free services Allocation driven by social forces	Fewer but larger users Employers are primary users Large schemes Long value chains Services to buyers Market forces drive allocations
Risks	New economic reality Disinvestments and capital flight Fast speed of change Water less available Legal challenges Depresses GDP	Growth >6% needed Political shifts reverse market progress Slow speed of change Not enough developed skills and resources HIV / AIDS undercuts workforce International events discourage investments

At this time, South African policy seems to favor the economic growth model. But it needs to make significant progress in the next five to ten years to avoid pressure for a more redistributive water allocation model.

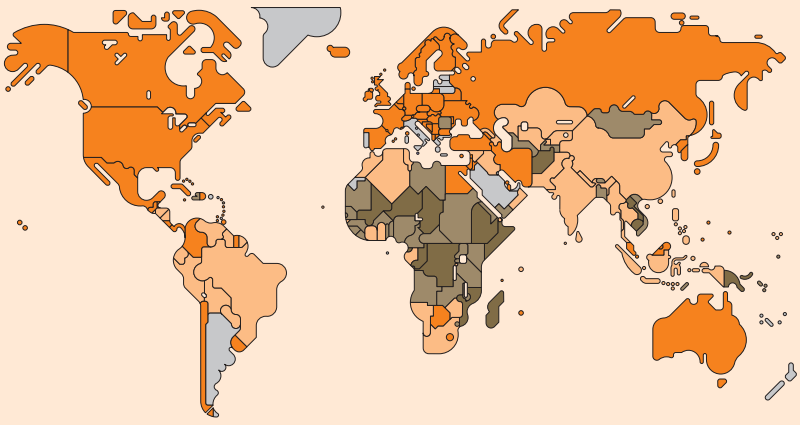
Source: Quibell, personal communication, 2006.[16]

Africa and Water

Improved Drinking Water

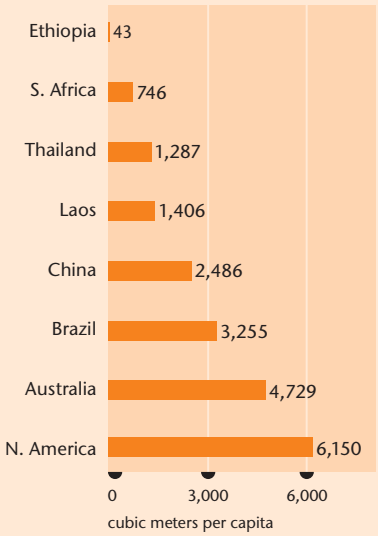
Percentage of population using improved drinking water sources, 2002

Less than 50% · 50% - 75% · 76% - 90% · 91% - 100% · Insufficient data



Source: Adapted from UNICEF and WHO, "Meeting the MDG Drinking Water and Sanitation Target," 2004.[17]

Water Storage



Source: Adapted from Grey and Sadoff, "The Global Water Challenge," 2006.[18]

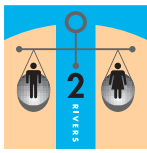
by the rising competitiveness of India and China, continues to grow. Political unease is further reinforced by the social tensions arising from a wave of immigration caused by the serious droughts that affect Africa and the Middle East.

Government initiatives to stimulate the EU economy by relaxing environmental protection measures face fierce opposition from environmental groups. At the same time, against the background of the failure to meet the Millennium Development Goals, development NGOs gain increased public support as the media pour out an endless stream of harrowing stories about the great droughts and famines.

In many of these stories the finger of blame is implicitly pointed at business for its perceived championship of unbridled globalization and privatization.

Local Partnerships

As businesses gradually begin to accept that water security is as much a matter of water policy as of water efficiency or technology, many begin to form public-private partnerships with local water suppliers and municipal governments. While sometimes difficult to manage, such partnerships begin to offer solutions for both people and businesses. A body of knowledge around best practice for such partnerships begins to emerge, and companies find that the more they participate in helping to shape water policy through offering solutions based on their expertise, the more likely it is that they will ensure a sustainable water supply for their own needs.



Water Wars: Is Conflict Inevitable?

> **The wars of the next century will be about water**
>
> *World Bank Vice President Ismail Serageldin, 1995*

Water resources have rarely, if ever, been the sole source for conflict. Nonetheless, water resources or systems have played a role in numerous conflicts:

- **Control of water resources – water supplies or access are at the root of tensions.**
- **Military tool – water resources or systems are used as a weapon during a military action.**
- **Political tool – water resources or systems are used for a political goal.**
- **Terrorism – water resources or systems are either targets or tools of violence or coercion.**
- **Military target – water resources or systems are targets of military actions.**
- **Development disputes[19] – water resources or systems are a major source of dispute in the context of economic and social development.**

Most conflicts over water break out *within* nations – "in the last 50 years, only 37 disputes involved violence, and 30 of those occurred between Israel and one of its neighbors. Outside of the Middle East, researchers found only 5 violent events while 157 treaties were negotiated and signed... Today, more than ever, it is time to stop propagating threats of 'water wars' and aggressively pursue a water peacemaking strategy. Why?

- **Water management offers an avenue for peaceful dialogue between nations, even when combatants are fighting over other issues.**
- **Water management builds bridges between nations, some with little experience negotiating with each other, such as the countries of the former Soviet Union.**
- **Water cooperation forges people-to-people or expert-to-expert connections, as demonstrated by the trans-boundary water and sanitation projects Friends of the Earth Middle East conducts in Israel, Jordan, and Palestine.**
- **A water peacemaking strategy can create shared regional identities and institutionalize cooperation on issues larger than water, as exemplified by the formation of SADC (Southern African Development Community) in post-apartheid southern Africa."[20]**

> **“Whisky is for drinking.**
> **Water is for fighting over.**
>
> *Attributed to Mark Twain*

The experience of partnering with local government entities alerts businesses to the seriousness of the unsolved allocation problems around the world. Many begin to pay closer attention to their own water allocation context, even where no immediate business interest appears to be involved. Allocative efficiency – the challenge of reallocation – requires consideration of water impacts and needs across the water system, including the impact of point-of-use products and services and the burden-sharing of impacts associated with waste discharges.

In this context, far-sighted companies who have already developed water metrics and reporting systems and who have gained acceptance of these from other stakeholders are at a clear advantage.

By 2010, recognition that water security is closely tied to energy security has led to integrated resource conservation policies and strategies. Water treatment and transport require energy, and the production of energy often requires water. So water security comes as a pair, along with energy security – “the continuous availability of energy in varied forms, in sufficient quantities, and at affordable prices.”[21]

Not all countries enjoy a democratization of the water allocation process. But even in some of these countries, the alignment of local jurisdictions to national government policies enables improved water governance. By 2020, it is common business practice to analyze how tensions in water allocation policy might impact existing and new markets. For business, the world of water lies beyond issues of quantity and quality to concerns of access and equity.

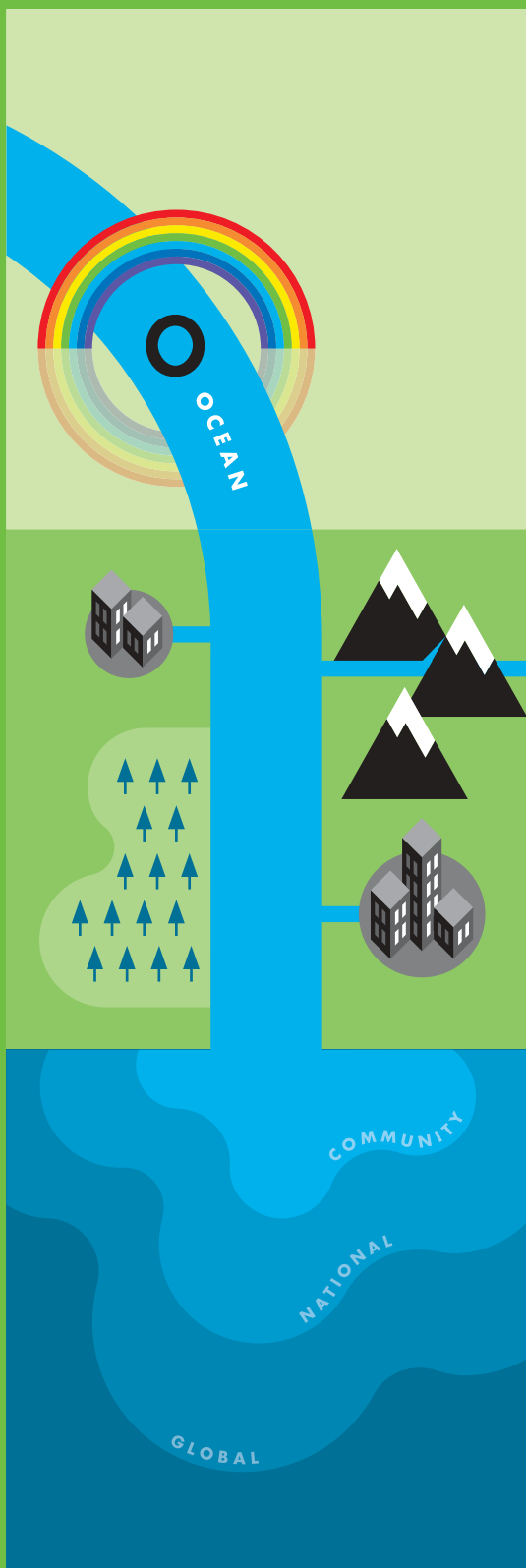
Building Bridges on Shifting Foundations

In ***Rivers***, a number of businesses create cross-sectoral partnerships with local authorities to address water access and use issues. But many of these partnerships struggle with the added challenge of taking into account the shifting foundations on which they have been built. The wider waterscape is continually shifting, in part because of conditions arising from climate change, water transfers embedded in traded goods and services, and the culmination of historical pollution legacies and over-abstraction practices. But even more unstable than these factors is the increasingly volatile local political landscape in which the issue of water is frequently used because it can trigger intense emotions.

By 2025, the specter of famine is on the rise in several countries that have historically been food self-sufficient. The situation is being driven not by distribution problems or a local lack of water, but by the misallocation and inadequate management of water within several of the larger food-exporting countries. Disputes about the trade in virtual water abound, and demand for a return to national food self-sufficiency intensifies.

Although local partnerships solve many local problems, in ***Rivers***, upstream solutions sometimes have unintended downstream consequences. And the focus on human needs for water in the short term sometimes neglects the effects of human solutions on the long-term health of critical ecosystems.

O = Ocean



O = Ocean

Ocean is the story of how business begins to engage with political processes and multiple stakeholders in a world of bigger, more complex, interconnected, and dynamic water systems in which ecosystems, economies, societies, cities, and individual human lives are embedded. To navigate through this sea of complexity requires long-sighted policies and clear-headed leadership of networks. Like the entirety of the ocean, the enormous whole round 'O' of H2O is difficult to see, much less to act in relation to – but if we could imagine . . .

Asleep at the Water Wheel

Water increasingly appears on the global agenda, at least to judge by the number of global water meetings that are held. But although almost all these meetings end with a resounding call to action, the net effect is to produce a kind of apathetic sinking into the status quo.

One cause of this 'lulling to sleep' effect is that the media reports from these meetings focus on the emotional issues of profit and privatization rather than the pragmatic issues of analysis and implementation. Where reporters do manage to reach beyond the 'blame game', they often focus simply on the bright promises of technology – thermal and membrane technologies for desalination, bio-solutions, and the like. Thus, the way the water story is reported is either broadly dramatic, with no scope for partnership, or narrowly optimistic, with no room for tackling the huge, systemic problems that require profound reflection and diverse approaches.

In addition to the way the story is reported, a second cause of the lulling effect is that the huge scope of the problem is apt to lead to a sense of helplessness. A third cause is that when practical, short-term suggestions are offered, the regional nature of these suggestions allows many participants to shrug off responsibility for water problems in countries or river basins with which they have little to do.

So the optimists can look to technology to solve the water problem; the pessimists feel justified in giving up; and the apathetic can remain comfortably uninvolved.

Unintended Consequences

With growing water demand and greater challenges to water quality, the water haves become increasingly reluctant to give up what they feel they need. In the race for competitive efficiency, agricultural goods, for example, do not always reflect the comparative advantage of their water context – some water-intensive crops are grown in irrigated fields in water-poor regions rather than being imported from more naturally water-abundant locations.

Even in China, the mismanagement of natural resources, especially water, in the period of 1980-2006, coupled with poor regulatory enforcement and corruption, have laid the foundations for a pattern of boom-and-bust in the Chinese economy. This economic volatility exacerbates social tensions and threatens to presage a period of global economic volatility. By 2008, it is clear worldwide that short-term solutions don't always serve the large ecosystem or the interests of sustainability.

As globalization widens the gap between rich and poor in every country of the world, water becomes a key symbolic focus of protest. Increasingly, for example, local communities in Africa and Latin America complain that their water is being used for 'rich-country lifestyles'. By 2010, activists are protesting against companies more often for 'unfair water practices' than for exploitative labor practices.

Then, in 2015, two water-related events occur that throw light on what is rapidly becoming a global problem and results in a worldwide water rights movement that becomes quite powerful in its calls for water sanctions on companies and for global water protocols.

The first event is reported in a Pulitzer-prize winning US newspaper series that garners worldwide attention. A large international food company, which has outsourced the growing and processing of chickens to Brazil, becomes embroiled in a dispute over the use of water in one of its processing plants. The villagers downstream from the plant claim that too much water is being taken from the river for the chicken processing, leaving too little for their needs, including for basic drinking water. Since these chickens are destined for dining tables in northern Europe, the article points out that the Brazilians are suffering from an unintended consequence of global trade – in effect, exporting their precious water while local populations suffer from shortages.

In the same month that media worldwide begin exploring the implications of food export, several grocery chains that distribute imported vegetables report that some have become contaminated through the water used in the growing process. When US shoppers begin to boycott produce imported from Latin America, representatives of Latin American agricultural interests call for a voluntary boycott of US goods, a move that threatens to undermine the North American Free Trade Agreement (NAFTA).

A few weeks later, it is reported that an unusual number of inhabitants of a mid-sized city on the East Coast of the US are suffering from *Cryptosporidiosis* (a parasitic disease). Reports compare this incident to the 1993 'Crypto' outbreak in Milwaukee caused by contaminated drinking water that sickened 400,000 people and resulted in more than 100 deaths. Soon after this outbreak is confirmed, it is announced that the city also has an unusually high number of cases of *MRSA (Methicillin-resistent Staphylococcus aureus)*. News reports point out that conventional wastewater systems provide an environment for the spread of antibiotic resistant genes in bacterial populations, contributing to the increase in multi-resistant micro-organisms and a dramatic loss of effectiveness in fighting bacterial infections with currently available antibiotics. A rumor quickly circulates

that a third incident is about to happen, perhaps involving terrorists, who, it is said, have the means to poison the water supply.

A week later, a third event does happen – five confirmed cases of cholera in London. Although all cases were traced to international travel, the rash of water-borne diseases in industrialized countries energizes a global Fair Water Movement, which is tied together by the Internet and loosely organized to protest any number of perceived results of globalization. Many of the protestors are veterans of the anti-WTO movement of previous years.

The Global Fair Water Movement

Fair Water Movement proponents argue that if water quality is being threatened even in advanced industrialized nations, some global standards need to be developed to guarantee the right to clean water for all humans on the planet – and since this is a basic human right, it should be enforced, beginning with actions against non-conforming WTO members. Supporters point out that this declaration is not revolutionary – after all, they say, this is the gist of General Comment 15 to the Declaration on Human Rights. In some ways the Fair Water Movement is like the General Agreement on Public Services (GAPS) proposed in 2005, which reflected on the internationalization of services and the need to establish a more equitable basis for service provision and regulation across international boundaries.

But others feel the goals of the Fair Water Movement are too constraining, insisting on a generalized mode of approach when it's not clear exactly how much water any given human being in any specific situation needs. Business risk in a protocol-dominated world seems impossibly vague and broad, especially in a litigious environment where rising expectations call for increasing personal, recreational, and food-related uses of water.

A number of manufacturing interests mount a campaign to counter some of the more extreme standards being suggested and to argue that technology will help solve the problem. But others argue that technology alone will not solve the problem, and that when it comes to water, both the haves and the have-nots must be served – and that is a matter of governance, not just technology. A number of multinationals support the Fair Water Movement, in large part because they feel it might address a common situation – being caught between the globalizing elites and the localizing communities and often between the competing claims of different communities in a single country.

The worldwide attention given to the Fair Water Movement and the three water crises of 2015 have made corporations more attentive than ever to liability issues. As a result, many companies begin to focus on global governance issues and the avoidance of liability rather than on narrow issues of corporate social responsibility in local contexts.

The Tipping Point – A Decade of Floods

Ironically, what begins to wake up the business community to the importance of water as an issue is not drought or another kind of crisis in water security or the demands of the global Fair Water Movement, but the series of floods that continue to occur all over the world from 2005-2015. Some of these floods, such as the New Orleans flood in the middle of the decade, illustrate the dire consequences of poor water management for business profitability and the grave danger many coastal cities face. After the New Orleans flood, ordinary citizens begin to tell their own cause-and-effect stories: that climate change might be leading to increasingly destructive hurricanes

Coastal Cities and the Rise of the Sea

The rise of the sea affects many people and will be very costly.

- **Approximately 37% of the global population (over 2 billion people) lives within 100 km (60 miles) of a coastline.[22]**
- **Bangladesh, one of the world's poorest nations, is also the country most vulnerable to sea-level rise. Catastrophic events in the past have caused damage up to 100 km inland. It is hard to imagine how grave these catastrophes would be with accelerated sea-level rise. A 1.5 m rise would affect 17 million people and 16% of the land area.[23]**
- **To keep the present functions and level of stability for 1,000 Japanese ports in the event of a one-meter sea-level rise would cost 110 billion US dollars.[24]**
- **"In central London, the urban heat island effect currently adds up to a further 5 to 6°C to summer night temperatures, and will intensify in the future... Relative sea level in the Thames Estuary will continue to rise by between 26 and 86 cm by the 2080s and will rise further in the future."[25]**

and that global warming might result in a sea level rise that would threaten dozens of major cities along US coasts. In Europe and Asia, the increased rate of glacier melting has resulted not only in a reduction of base flows of rivers in summer but also in faster discharge, thus reducing the glacial water storage effect.

In Asia, deforestation for economic growth results in an increasing number of floods and mudslides that destroy whole villages. In Europe, frequent high-intensity, short-duration rainfall events lead to increased flooding in Germany and The Netherlands – and these floods, combined with a westerly storm, create a significant impact on the industrial complexes in the Ruhr and Rotterdam. In London, as well as in a number of cities in Eastern and Central Europe, the poor state of sewerage networks allows frequent overflows of untreated sewage, leading to a significant increase in massive fish kills and depression of waterfront real estate values.

Unintended Consequences Multiply

These continuing water problems in Europe and the tragedy of a second major New Orleans flood in 2015 underscore the idea that the short-term, local solutions offered in the US and Europe are inadequate. Regional solutions don't address the unintended consequences of decisions made elsewhere. Higher dikes in The Netherlands, for example don't address the wetlands destruction in Germany. And the drive for biofuels in Southern Europe ignores the effect on scarcer water resources.

Africa suffers from even more destructive unintended consequences. Well-intentioned aid projects have actually foreclosed some of the opportunities to improve water quality and supply. Poor institutional capacity, vast geographical distances, the distance of the inland population from desalination solutions, and the increasing desertification of the land all contribute to the pressures on water. Without water, Africa becomes a less attractive market for business – which also means a loss of the economic opportunities that a developed Africa would offer.

Meanwhile, the US drive to energy self-sufficiency has resulted in an enormous push for more biofuels, leading to tensions in water-stressed parts of the US as well as increased reliance on food imports from Brazil, among other countries. The unintended consequence of this economic boon for Brazil, which has also aggressively developed biofuels from sugar cane, is that as the Amazon forests are cleared for agriculture, the entire region begins to suffer from severe droughts. In many parts of Brazil, the destruction of the fish and crops that form the lifeline for indigenous communities is beginning to raise the awareness that Brazil is exporting a valuable resource – the 'virtual water' used in the production of its exports – at a significant local cost.

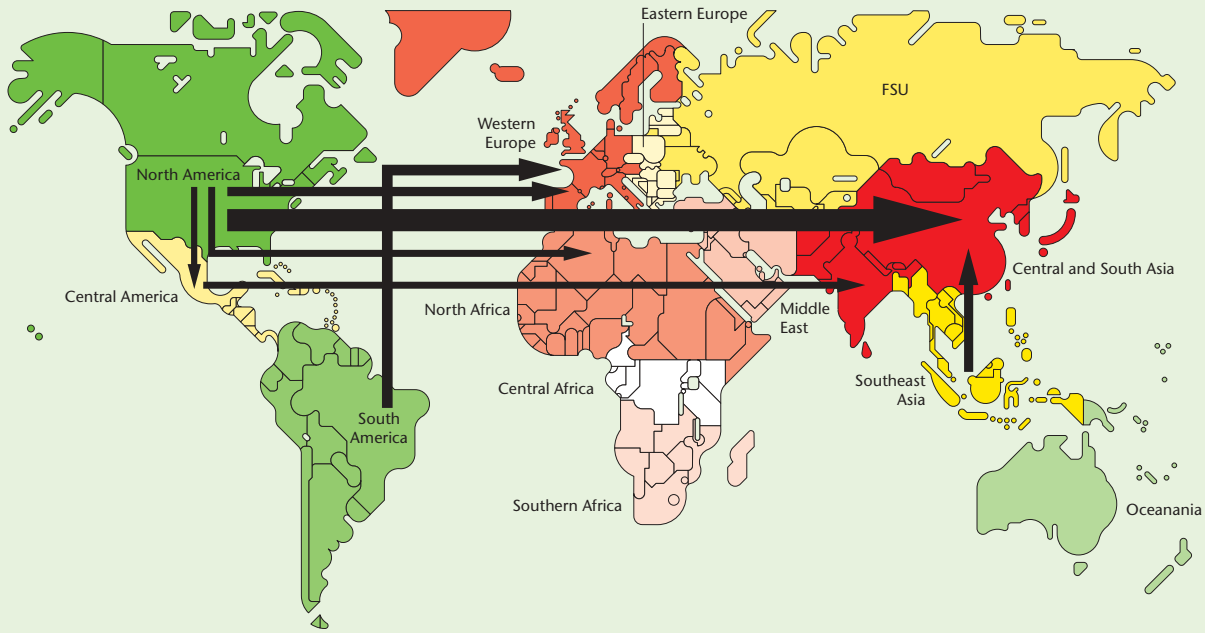
As the Fair Water Movement gains more supporters, some activists begin using tactics such as boycotting of companies who depend in any way on 'unfair water' – that is, water that movement activists claim should have been used for more direct, human purposes. But other activists begin to take a more inclusive approach to the problem. And gradually, in much the same way that NGOs began to work with corporations to address environmental problems, some Fair Water Movement activists also begin establishing non-adversarial relationships with corporations, with the initial intent of making the water footprint of corporations and companies more transparent.

The Water Footprint

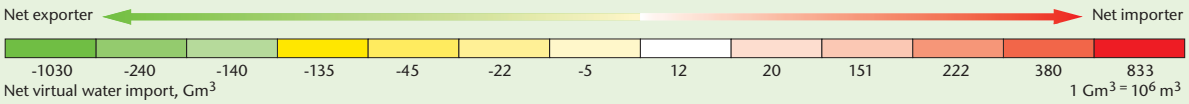
By 2010 many countries require companies to report their water footprints – the total volume of water used directly or indirectly to produce goods and services. Meanwhile, the UN publicizes its report on the water footprint of countries.

Virtual Water Flows in Traded Crops

Products are transported around the world, along with the water embedded in them.



Virtual water trade balances of thirteen world regions over the period 1995-1999.
Green to yellow coloured regions have net virtual water export; white to red coloured regions have net virtual water import.
The black arrows show the largest net virtual water flows between regions (>100Gm³ per year).



Source: Adapted from Hoekstra, Hung, and IHE Delft, "Virtual Water Trade," 2002.[26]

The spotlight on water footprints grows more intense in 2015 when the UN declares that water stress and the placing of narrow economic priorities over water and other basic human needs contributed significantly to the failure to meet regional and local Millennium Development Goals. Companies respond defensively by striving for clarity of communication about their own internal water policies as well as where they stand in the multi-stakeholder dialogues that usually accompany the settling of water issues.

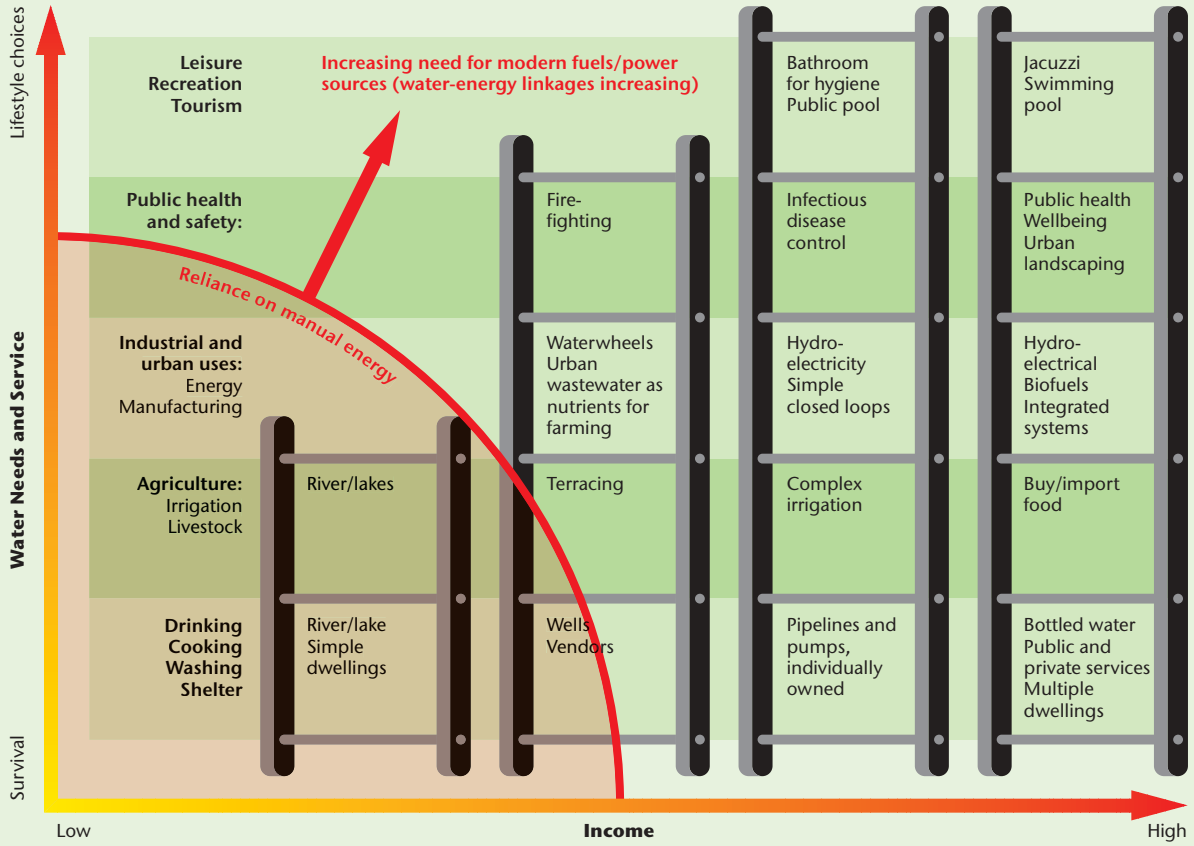
Using the successes of previous global environmental campaigns as their models, Fair Water activists and supportive companies and governments insist on the kind of 'total accounting' that is needed to understand the cost of the displacement of water-related problems from one part of the world to another. Activists point out precedents for such total accounting in relation to child labor, acid rain, deforestation, sustainable fisheries, and carbon trading. They also point out that the world of water is highly fragmented and that the focus is on basin management at a time when virtual water is making water a global issue.

Increasing attention paid to water issues leads to their emphasis in education in a relatively short period of time. Water joins air, land, and energy as part of the responsible citizenship and sustainable consumerism curriculum that has replaced the earlier environmental curriculum in many schools. Just as every school child knows something about pollution and global warming, more and more of them now accept as common knowledge such basic water concerns as the fact that the higher up we go in the food product chain, the higher will be the virtual water content of the product.

In addition, more attention is given to success stories of the past, such as that of the Swiss Law on Forests, which regulated the forest clear-cutting that had caused floods, erosion, and mudslide-ravaged valleys and cities. Particular attention is paid to guiding principles in these success stories: for example, in the Swiss Case, the legislation is designed to promote sustainable watercourse management through the three

The Water Ladder

As per capita income increases, demand for water also increases. Similarly, energy demands also increase with income. The water ladder impacts other ladders – for example, the hygiene ladder, the food security ladder, and the dietary preferences ladder.



Source: WBCSD Water Scenario Team

principles of adequate space for watercourses, adequate water flows, and adequate water quality.

Networked Global Water Governance

By 2020, a global consensus is emerging in all three sectors – government, business, and civil society – that while the complex world of water cannot be controlled, it should be better managed. The consensus gathers around key elements, including:

- **Market mechanisms**, such as water pricing and trading in virtual water, that help solve water supply problems while at the same time protecting watersheds.
- **Enlightened legislation** that creates incentives for better water management and results in a stable, but flexible, regulatory framework that enables markets to work effectively.
- **'Whole-system framing'**, which means that all parts of the system are represented in finding an acceptable way forward.

This consensus is managed in individual river basins and regional water areas, which are beginning to work together to achieve larger ends. But beyond 2020, the questions are: When does regional interdependence need to be governed globally, and what institutional mechanisms are needed to ensure enough fair water for all development aspirations?

The learning curve related to water rises much more sharply than the earlier one related to the environment. This is in part because the world is more globally interconnected and in part because experiments that extend carbon trading to so-called carbon cap-and-trade systems begin to offer a model for what might be done in relation to water. The key to mobilizing business action on climate change is the provision of a market-based incentive – a price on carbon – coupled with a geo-politically acceptable agreement on quotas and reductions.

By 2020, financial markets are trading water virtually, and companies with large water footprints engage in virtual water trading on the basis of fully priced externalities. One of the most unexpected developments

Managing the Panama Canal

Over a quarter of Panama's GDP depends, directly or indirectly, on the contributions of the Panama Canal. The Canal runs solely on freshwater from a watershed contained entirely within Panama's borders, which also provides this resource for supplying about half of the country's population. This unique coincidence of political and ecological geography has enabled Panama to become a world trade, transportation, and logistics liaison center. At the same time, the country has forged ahead in putting Integrated Water Resource Management into practice.

An increasingly complex combination of domestic and global factors will affect the longer-term outlook of the Canal. For example, as worldwide trade grows, the shipping industry trend is to increase the use of larger ships that cannot transit through the Canal's locks. Population growth, urbanization, and economic development have brought a growing set of water-related needs and wants. In response, the country is taking steps to balance the allocation of the Canal watershed resources to meet municipal demands, agricultural development needs, indigenous life-styles, and economic diversification.

In the face of such whole-system changes, Panama cannot control the dynamic interplay of economic globalization, environmental challenges, and socio-political development, but it has chosen to enhance its ability to anticipate and adapt in order to ensure a better common future.

is the emergence of water-based economic zones. These flourish on the back of the increasing number of countries who have established bilateral trading agreements based on national comparative advantages in water. Similarly, more city mayors are collaborating with farmers on ways to measure and reduce municipal water footprints and underwrite water efficiency improvements in the local agricultural sector.

All of these developments have been enabled by factors such as the ability to generate reliable quantitative information about water and the growing role of water in socially responsible investment programs. Risk management is seen not only as an issue for individual companies in their relation to 'fair water,' but also as a matter of the resilience of societies – and of the global water system as a whole.

In addition to these market mechanisms, governments are contributing to a new water world as well. Legislation across Europe, the US, and Asia begins to address the true value of water and the interaction of the complete water cycle. Laws focus on such issues as reduced water losses, recycling and reuse of industrial water, and new standards in water and sewerage network quality. Governments subsidize water-saving technology as well as water itself to promote conservation in the agricultural sector. Citizens the world over begin to see that the Millennium Development Goals cannot be achieved without a sustainable water foundation – you can't make progress in education for girls, for example, if they are spending all day fetching water.

In the world of ***Ocean***, an increasingly complex interchange develops between the use of new market mechanisms, new laws that encourage best practice in water resource management, and a developing body of global governance practices that recognize the interdependence of everyone in the world of water. In this new world, business plays a key leadership role.

Water footprint
The total volume of freshwater used by individuals, businesses, or nations to produce and consume or use goods and services

Navigating with the WBCSD Water Scenarios

“Thinking is easy, acting is difficult, and to put one’s thoughts into action is the most difficult thing in the world.

Goethe

Where Do These Stories Lead?

For those of us who had the good fortune to participate in this scenario process, the stories have helped us to think, see, and act differently about water. The process has helped us to see the ‘obvious’ (what we already knew) in more focus. It has provided us with new information and insights and given us the inspiration and incentive to imagine some of the complexities that the water future will bring.

Our understanding of the factors driving change – the five ‘Ps’ (planet, people, past, politics, policies) – leads us to believe that the water challenge facing our world is potentially as serious as climate change. To face this challenge, we isolated just three of the many themes to which businesses, individually and collectively, need to pay special attention, and in relation to which they can contribute and make a difference: *innovation, security and allocation*, and *connectivity*.

Each of us is now faced with the need to do something useful with what we have gained.

Conscious of this need to disseminate understanding so that it can contribute to action and change, we conducted an exercise in the last part of our final workshop. Participants heard the stories and then were asked to come up with key messages, lessons, or challenges for each scenario and for the scenarios as a set.

	Messages from ‘H’ – **Hydro**	Messages from ‘2’ – **Rivers**	Messages from ‘O’ – **Ocean**
Some of the companies initially involved in the project came up with messages from the scenarios based on a workshop discussion. Examples of some of the messages include:	• Technology is only part of the solution. • Appropriate solutions involve participation and partnerships and do not necessarily mean ‘high tech’. • Relevant innovation is driven locally.	• Business cannot buy its way out of water problems. • Business must engage and negotiate outside its fenceline, within the territory of the ‘other’, in order to secure its activity. • Creating trust helps to secure the license to operate.	• Take into account the changing water context in order to anticipate risks that stem from far outside your current business model or comfort zone. • Connect all the components into a whole system to create opportunities to which you would otherwise remain blind. • A new level of accountability and governance is required.

Messages from the Scenarios as a Set

- **Business cannot survive in a society that thirsts.**
- **You don't have to be in the water business to have a water crisis.**
- **Business is part of the solution, and its potential is driven by its engagement.**
- **Growing water issues and complexity will drive up costs.**

Our Vision – The H2O Scenarios as a Platform for Action

Water issues are very complex and interconnected. Business is one actor among many in the world of water. It has an important role to play in meeting the emerging challenges and opportunities. We see business as being a part of the solution. Each business must play its part, as well as working with others.

A first step is for individual companies to reflect on the implications of the evolving waterscape for their own strategies and plans. The scenarios provide a set of alternative strategic contexts for enabling this reflection. This should help every company to have a clearer and more robust strategy to guide its future actions where water is concerned.

These scenarios can also be used to support engagement among diverse groups of businesses, such as the member companies of the WBCSD. Businesses can take constructive action together when they have a clear collective view of the challenges and opportunities posed by each scenario and the common implications of the scenarios as a set.

A further step is to engage with non-business stakeholders to explore and mobilize in relation to shared water challenges. These scenarios offer a platform for such discussions – the stories do not represent any one actor's perspective or one sector's position. Instead they aim to provide a neutral space in which a much wider set of options can be considered. In the complex world of water, multi-stakeholder dialogue is an essential first step towards mobilizing and sustaining collaborative action.

The above suggestions indicate some of the ways the WBCSD Water Scenarios can help a range of organizations and partnerships navigate the complex and dynamic waterscapes that are unfolding from local to global levels. Interconnected water challenges are beyond the responsibility and capability of a single organization or institution. The scenarios can support a move beyond talking to social learning and the forging of frameworks and partnerships that are needed to anticipate and adapt to these interconnected concerns.

Our vision is that businesses – together with others everywhere – can play an active and responsible role in ensuring socially equitable, ecologically respectful, and economically viable water management.

Some Questions for Discussion

Getting together to read and discuss the WBCSD Water Scenarios provides an opportunity for individual and institutional learning. The following questions are suggested as useful tools for anchoring initial discussions, but are aimed at providing guidance rather than being prescriptive. We hope that readers will be able to generate many more specific questions of their own.

Related to 'H' – **Hydro**

- Which legacies need to be unlocked to drive innovation?
- Where will cities face big water challenges?
- What appropriate solutions can you see and reach?

Related to '2' – **Rivers**

- What happens if the water haves and have nots issues are ignored?
- What constitutes fair water use, and who will decide?
- How can water conflicts be avoided?

Related to 'O' – **Ocean**

- What happens when the whole system isn't taken into account?
- How can virtual water be made more transparent?
- What are the tensions and

What Business Can Do

Businesses can take many actions – individually, collectively, and in partnership with others – to address the evolving water challenges.

Water footprint solutions

- **Reduce the use of water and pollution discharges/wastewater flows throughout the supply chain.**
- **Don't assume water will always be here.**
- **Produce products and services that reduce water usage and/or discharges by the end-user/customer.**
- **Help develop and promote appropriate solutions that take into account different contextual realities, such as culture, affordability, water scarcity, climatic variability, and economic diversification.**
- **Recognize that costs will go up, and water availability will come down – reduce consumption and save money.**

Partnership opportunities

- **Look beyond the plant/site boundary and fenceline/supply chain.**
- **Help raise a wider awareness of the water challenge.**
- **Be proactive in the local community, recognizing the opportunity of new markets.**
- **Contribute clear messages to political leaders about the importance of water policies and their equitable and consistent implementation.**
- **With other stakeholders, attempt to create a clear set of water principles.**

trade-offs in managing water resources and allocation at local *and* global levels?

Wider Questions on Water Issues

Businesses can also use the scenarios as a context for conducting a SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) – What are their company's specific *Strengths* and *Weaknesses* in each scenario, and how do they match with the more generic water *Opportunities* and *Threats* posed by each future? Again, the following list of suggested questions can be used to help anchor and initiate this sort of strategic conversation:

- How is your business dependent on water for its success today – upstream, midstream, downstream?
- Do you know and understand your water supply, treatment, and disposal context? Do you know the influential institutional and/or governmental individuals who deal with water in your business community?
- Can you assess your water footprint? What measures do you have in place to monitor water use? What do your competitors do? What is best practice?
- If the quality, availability, or cost of water for your suppliers, yourselves, or your customers/consumers changed significantly (x2, x10) in the next 5, 10, or 20 years, how would your business be affected? Do you consider water in your long-term strategic planning?
- What are the generic opportunities and threats in each scenario? Who is the prime mover – that is, which organizations and institutions are setting the standard?
- Reading the scenarios – ask yourself not "whether", but "what if" – how would your business be affected if this future came true? Which aspects of each scenario are particularly relevant to your products and services? What other water dimensions need to be added? Which water challenges and opportunities seem most relevant to you as a citizen? A consumer? A businessperson?
- Considering the scenarios as a set, what do you now think are the biggest risks and opportunities for your business' operations, investment decisions, products, or services in an increasingly water-stressed world?
- Who might be new partners or stakeholders in judging your business operations or in providing new and better solutions to grow your business?

The Water Scenarios in the WBCSD

Individual member companies within the WBCSD plan to use the scenarios within their own organizations. In addition, as it continues its work on water, the WBCSD will provide a platform for sharing experience and insights gained through the application of the scenarios.

It will also make the scenarios and related material available to partner organizations in the WBCSD Regional Network.

Other projects of the WBCSD work program will use the scenarios to assess possible implications for their areas of focus.

Conclusion

The team working on this scenario project has found it to be an extremely stimulating and rewarding exercise. It has built up high levels of enthusiasm about meeting the water challenge and convinced us that concerted action is essential in the very short-term if water crises, already a reality to many, are to be overcome successfully. We believe that these scenario stories and the deep insights that emerge when we work with them

will help our businesses to contribute to water solutions. We look forward to using them as a part of our continued engagement on water issues with other stakeholders.

A common approach to shared water issues has always been a pillar of all civilizations. Water is never static. The world is a constantly changing place. To keep afloat and navigate safely through the uncharted future, everybody needs to look at water with flexibility and determination. Our intention and desire is that these scenarios will help this happen.

Which Water? What Actions?

The purpose of this box is to aid future thinking about the different types of water and the policies and business actions that might flow from the three scenarios.

Scenario	Priority	Type of Water Managed or Taken into Account	Possible Options for Water Management Policy	Possible Options for Business Actions
Hydro	Water-use **efficiency**	**Blue water** (surface and groundwater in watersheds) The urban and industrial water and wastewater cycle Irrigation water	Price signals used to incentivize economic efficiency Integrative solutions to manage energy - water - food linkages New standards for water use efficiency	Not wasting blue water 'Spinning' the water cycles faster to maintain sufficient supplies Collaborating to help close the supply-sanitation gap Technological innovation, including measuring, sensing, and modelling techniques Water audits
Rivers	**Security** of water, environment, and economy	**Blue water** and **green water** (soil water) in and beyond the watershed The urban and industrial water cycle	Information-based policies and implementation Allocative efficiency and environmental consideration	Consideration of fair water issues Water risk assessments Measuring, sensing, and modelling techniques used to explain and justify water use
Ocean	**Integrated management** of fair **allocation** through constructive **political** engagement	**Blue, green,** and **virtual water** (water traded in commodities), often beyond the local watershed	Mix of mechanisms and valuations – **market** (including trade), **participatory** (voluntary), and **regulatory** (accountability) – all varying by country/river basin	Water footprint measurement Life cycle and supply chain considerations (sites, organizations, products) Water rights and pollution permits trading

Glossary

Allocative efficiency – The allocation of water resources in a way that maximizes the net benefit attained through the use of water across a range of applications – household consumption, food production, consumer goods, employment, and urbanization.

Blue water – The liquid water flowing in rivers and aquifers.

Green water – Water in the form of soil moisture and evaporation.[27] Sixty percent of all rainfall never reaches a river or aquifer but replenishes the soil moisture and evaporates from the soil or is transpired by plants. [28]

Legacy – Something handed down by a predecessor.[29]

Rebound effects – Secondary, negative effects of primary water-efficiency improvements – for example, the use of energy-efficiency savings for long-haul, energy-intensive trips, or the increase in water-consuming activities made possible by the increased savings of income achieved through improved water efficiency.

Renewable water – Traditionally, what is defined as 'renewable water' is only the rainfall that runs off into rivers and recharges the groundwater – which is only 40% of total rainfall. This is also called 'blue water'.[30]

Sustainable water management – Enough water, of sufficient quality, at the right time, and at the right place to meet the ongoing needs of this and future generations and of the ecosystem as a whole.

Virtual water – An economic concept. It corresponds to the volume of water required to produce a foodstuff or a given object (and should not be confused with its actual water content). It is normally expressed in liters of water per kilogram. For example, it takes approximately 1,500 liters of water to produce one kilogram of wheat, and 4,500 liters for 1 kilogram of rice. 'Virtual water' is the water embedded in traded goods.[31]

Water footprint – The total volume of freshwater used by individuals, businesses, or nations to produce and consume or use goods and services.[32]

Water scarcity – An imbalance of supply and demand under prevailing institutional arrangements and/or prices; an excess of demand over available supply; a high rate of utilization compared to available supply, especially if the remaining supply potentials are difficult or costly to tap. Because this is a relative concept, it is difficult to capture in single indices. However, current utilization as a percentage of total available resources can illustrate the scale of the problem and the latitude for policy-makers.[33]

Water shortage – Low levels of water supply of adequate quality relative to minimum levels necessary for basic needs. Can be measured by annual renewable flows (in cubic meters) per head of population, or its reciprocal: the number of people dependent on each unit of water (for example, millions of people per cubic kilometer).[34]

Water stress – The symptoms of water scarcity or shortage, for example, growing conflict between users and competition for water, declining standards of reliability and service, harvest failures and food insecurity. Difficult to capture in numbers, though a checklist approach is possible.[35]

References

[1] United Nations Environment Programme, "Fresh Water Stress" graph in the series of "Virtual Water Graphics," 2002. http://www.unep.org/vitalwater/21.htm#21b (accessed 12 July 2006).

[2] Grey, D. and C. Sadoff, "The Global Water Challenge: Poverty, Growth, and International Relations," World Bank Global Issues Seminar Series, 25 January 2006.

[3] United Nations-Habitat, World Health Organization, and United Nations Department of Economic and Social Affairs. *Cities: Competing Needs in an Urban Environment.* March 2003.

[4] James, K. et al., "Watergy: Taking Advantage of Untapped Energy and Water Efficiency Opportunities in Municipal Water Systems," *Watergy*, 2002. www.watergy.org.

[5] United Nations. "Water For Life Decade 2005-2015," *UN-Water,* March 2005.

[6] ibid.

[7] Sandia National Laboratories. *Energy-Water Nexus Overview – US Energy Sustainability.* www.sandia.gov/energy-water/nexus_overview.htm (accessed 23 June 2006).

[8] United Nations. *World Urbanization Prospects – the 2003 Revision.* 2004.

[9] United Nations. *Freshwater Country Profile: China 2004.* http://www.un.org/esa/agenda21/natlinfo/countr/china/Waterf.pdf (accessed 23 June 2006).

[10] Brown, L. and B. Halweil, "China's Water Shortage Could Shake World Food Security," *Worldwatch* 11:4, July-August 1998, pp.10-21.

[11] Chinese Academy of Science. "Analysis of Water Resource Demand and Supply in the First Half of the 21st Century," *China Water Resources*, 2000.

[12] "A great wall of waste," *The Economist,* 19 August 2004.

[13] United States Department of Commerce International Trade Administration (ITA). *Water Supply and Wastewater Treatment Market in China.* January 2005.

[14] Speedy, A. W., "Global Production and Consumption of Animal Source Foods," *Journal of Nutrition*, American Society for Nutritional Sciences, Vol. 133, November 2003.

[15] Shove, E. 2003. *Comfort, Cleanliness and Convenience: The social organisation of normality.* Berg Publishing.

[16] Quibell, G., personal communication, 2006.

[17] United Nations Children's Fund (UNICEF) and World Health Organization. *Meeting the MDG Drinking Water and Sanitation Target: A Midterm Assessment of Progress.* 2004. www.unicef.org.

[18] Grey and Sadoff, *op. cit.*

[19] Adapted from Gleick, P., "Water Conflict Chronology in Environment and Security Water Conflict Chronology," Pacific Institute. 2004. http://www.worldwater.org/conflictIntro.htm (accessed 13 July 2006).

[20] Adapted from Wolf, Aaron T., Annika Kramer, Alexander Carius, and Geoffrey D. Dabelko, "Water Can Be a Pathway to Peace, Not War," *WorldWatch Global Security Brief.* 5 June 2005.

[21] Khatib, H. Hisham, "Energy Security," *World Energy Assessment: Energy and the Challenge of Sustainability*, United Nations Development Programme, United Nations Department of Economic and Social Affairs, World Energy Council (2000). http://stone.undp.org/undpweb/seed/wea/pdfs/chapter4.pdf (accessed 23 June 2006).

[22] Cohen, J. E., et al., "Estimates of Coastal Populations," *Science,* 278: 5341 (1997), 1211-12.

[23] United Nations Environment Programme. "Potential impact of sea-level rise on Bangladesh". Division of Policy Development and Law, http://www.unep.org/dpdl/indiaworkshop/vitcligra/figure5.htm (accessed 23 June 2006).

[24] Mimura, N.J., et al., "Impacts on Infrastructure and Socio-economic System," *Global Warming: The Potential Impact on Japan.* 1998. 165-201.

[25] London Climate Change Partnership. *London's Warming: Impacts of Climate Change in London – Summary Report.* October 2002.

[26] Hoekstra, A. Y., O. Q. Hung, and IHE Delft, "Virtual Water Trade: A Quantification of Virtual Water Flows between Nations in Relation to International Crop Trade". September 2002.

[27] Stockholm International Water Institute. "Let it Reign: The New Water Paradigm for Global Food Security". Final Report to CSD-13. Stockholm 2005.

[28] International Water Management Institute (IWMI). "Concepts Relevant to Management Issues: Comprehensive Assessment of Water Management in Agriculture," IWMI online, http://www.iwmi.cgiar.org/assessment/Synthesis/conceptsandterminology.htm (accessed 23 June 2006).

[29] *Compact Oxford English Dictionary,* online edition, "Legacy," http://www.askoxford.com/concise_oed/legacy?view=uk (accessed 23 June 2006).

[30] IWMI, *op. cit.*

[31] *Lexique EncycloBio*, "Virtual Water," http://www.citesciences.fr/lexique/definition1.php?idmot=369&rech_lettre=v&num_page=28&habillage=standard&lang=an&id_expo=25&id_habillage=36 (accessed 23 June 2006).

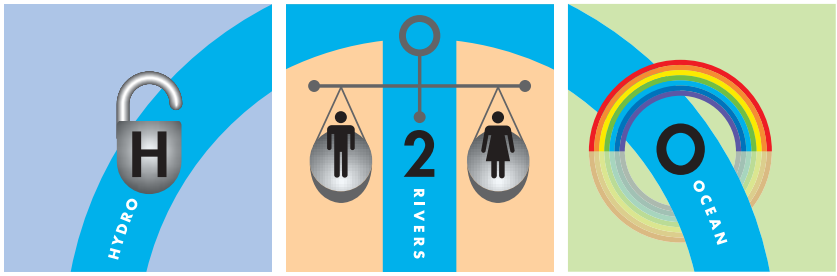
[32] Adapted from Chapagain, A. K. and A.Y Hoekstra, "Water Footprints of Nations," 1: 16 United Nations Educational, Scientific and Cultural Organisation – IHE: Institute for Water Education. November 2004. http://www.waterfootprint.org/Reports/Report16Vol1.pdf.

[33] Winpenny, J. T., "Managing Water Scarcity for Water Security," paper prepared for Food and Agriculture Organization (FAO). 1996.

[34] ibid.

[35] ibid.


H 2 O



4, chemin de Conches
CH-1231 Conches-Geneva
Switzerland

Tel: (41 22) 839 31 00
Fax: (41 22) 839 31 31

Email: info@wbcsd.org
Web: www.wbcsd.org